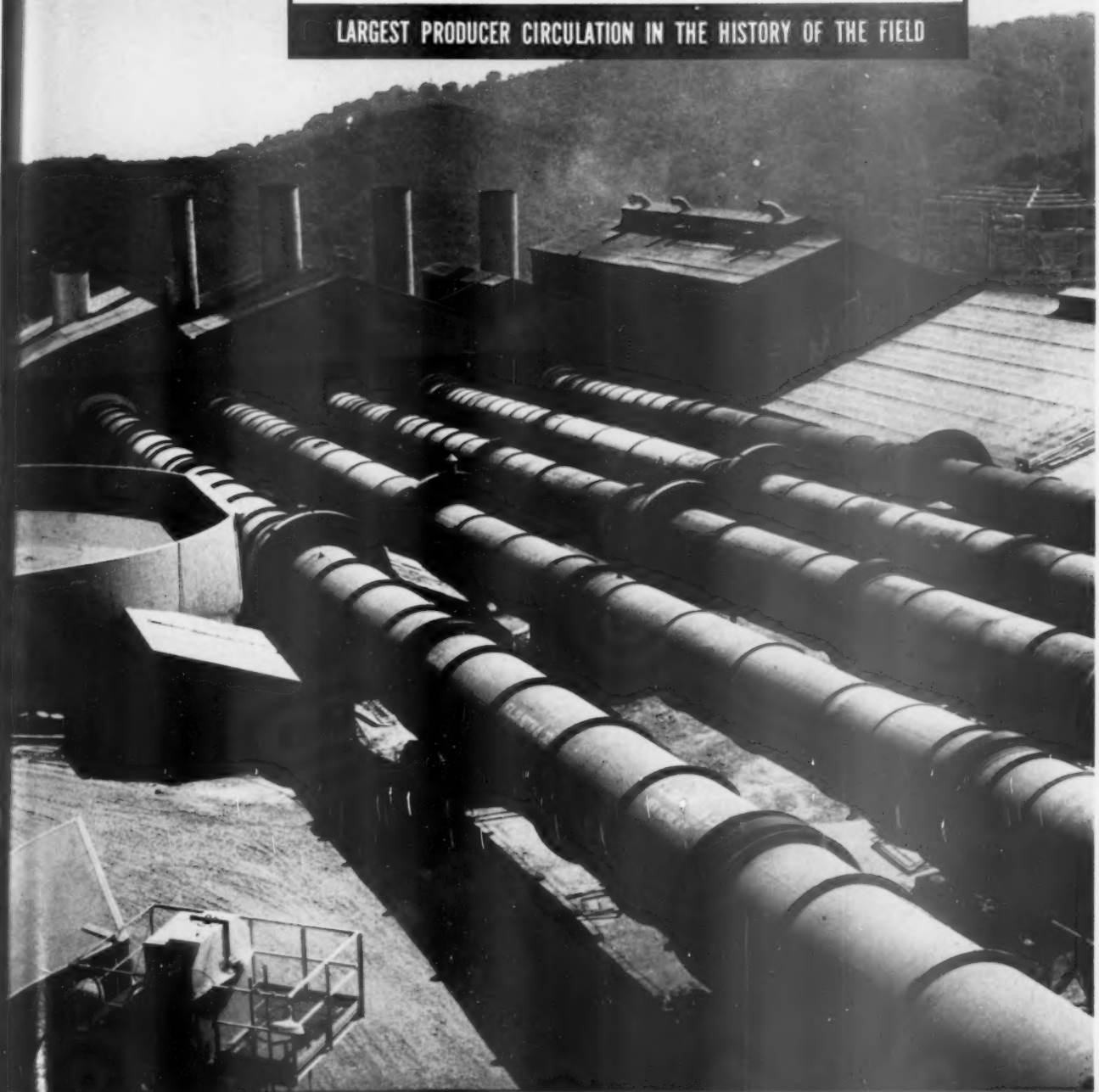
THE INDUSTRY'S RECOGNIZED AUTHORITY

ROCK PRODUCTS

MAY
1951

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD



Permanente's fifth 450-ft. kiln now in operation

30%-50% lower crushing cost

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BECAUSE POWER SHOVEL LOADED STONE IS CRUSHED TO 1½ INCH OR ¾ INCH... *IN ONE OPERATION!*

Here's the extra heavy duty hammermill that spells that welcome word *economy*. Built by Williams, the pioneer of the idea of crushing quarry stone to small sizes in one operation, the new Super-Slugger represents the latest improvements and the accumulated experience of many years in building heavy-duty hammermills. Savings result not only in initial investment... cost of foundations, conveyors, drives and buildings, but in faster operation and lower power consumption. If you require high tonnage output and a machine that can "take it" your investment in the Super-Slugger will pay off in more "pay-load"... and more profit! Write for bulletin 634 for detailed information of the newest Williams Super-Slugger.

WILLIAMS ALSO MAKES...

Heavy-duty hammermills in smaller sizes for all quarry operations; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

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WILLIAMS

CRUSHERS GRINDERS SHREDDERS

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Typical chains from the complete Link-Belt line

Class SS bushed roller chain with straight sidebars—for practically any conveying or elevating service.

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LINK-BELT

CHAINS AND SPROCKETS

MAY, 1951

ROCK PRODUCTS

THE INDUSTRY'S RECOGNIZED AUTHORITY

VOL. 54, No. 5

Bror Nordberg
Editor

Nathan C. Rockwood
Editorial Consultant

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"WE HEAR..."

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May, 1951

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This Month

ROCK PRODUCTS is published monthly by MACLEAN-HUNTER Publishing Corporation, 309 West Jackson Blvd., Chicago 6, Illinois; Horace T. Hunter, President; E. R. Gauley, Vice President; J. L. Frazier, Secretary, Copyright, 1951. Entered as second-class matter, Jan. 30, 1936, at the Chicago, Ill. post office under the act of Mar. 3, 1879. Additional entry at Milwaukee, Wis. ROCK PRODUCTS is indexed regularly by Engineering Index, Inc. and the Industrial Arts Index.

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"WE HEAR..."

May, 1951

The department of scientific and industrial research in Glasgow, Scotland, has reported that buildings made of a mixture of peat and concrete appear to be standing up well under the damp Scottish climate.

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The Revenue Department has charged a Canadian talc company, two of its top officials and an auditor with income tax fraud involving $120,000 over a 6-year period. The three men are charged with conspiracy to defraud the government and with making false entries in company books and records with intent to defraud.

* * * * * * * * * *

Construction in February, 1951, in the 37 states east of the Rockies totaled $1,140,527,000, or 9 percent higher than in the preceding month, and 46 percent higher than in February, 1950, according to an F. W. Dodge Corp. report. The total for the first two months of 1951 was $2,183,775,000, or 45 percent more than the comparable figure for 1950. The biggest gain was in non-residential construction which was up 78 percent over the first two months of 1950. Residential construction was up 35 percent; public and private works and utilities were up 11 percent.

* * * * * * * * * *

A substantial decline in the consumption of imported crude rubber in the United States in 1951 and an increase in the consumption of American-made rubber has been predicted by John L. Collyer, president of the B. F. Goodrich Co. Mr. Collyer declared, "Production of American-made rubber is being stepped up rapidly and should reach an annual rate of 925,000 long tons. This will permit a reduction of crude rubber usage of from 35 to 45 percent from the 1950 level."

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Purified air, necessary in certain industries, laboratories, hospitals, etc., can now be produced efficiently by a new filtering method using filters of asbestos and glass fibers. The filters can remove air-polluting particles of diameters smaller than one-thousandth of an inch, it is claimed.

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It has been estimated that the number of housing starts in 1951 will run from 800,000 to 850,000, which is a drop from last year's record of 1,400,000 homes. However, according to previous records, 800,000 is far above the average annual number of homes being built during the past 20 years. This decrease from the 1950 record is expected to be offset by a boom in remodeling and modernization.

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The widow of one of three men killed when a boat capsized in Lake Erie last fall has filed suit for $150,000 against an Ohio lime company. The suit contends that her husband died because the lime company's vessel was going too fast and had a defective cable and winch. She claims a cable from the vessel capsized a smaller vessel commanded by her husband who was attempting to take the cable to a moor bay.

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The Georgia highway department and the state's highway patrolmen are making a combined drive against overloaded trucks on the Georgia highway system. Patrolmen recently discovered that trucks were hauling up to 90,000 lb. on a highway built for vehicles with weights of not over 45,000 lb. Spot checks are now taking place with crews shifting without notice from one route to another.

WE HEAR

The Ordnance Ammunition Center, U. S. Army, Joliet, Ill., has announced the following ordnance plants are being or have been reactivated: Badger Ordnance Works, Baraboo, Wis.; Holston Ordnance Works, Kingsport, Tenn.; Indiana Arsenal, Charlestown, Ind.; Kankakee Ordnance Works, Joliet, Ill.; Radford Arsenal, Radford, Va.; and Sunflower Ordnance Works, Lawrence, Kan. These plants, essentially smokeless powder plants, operated at maximum capacity during most of World War II and, during this time, used lime for neutralizing large quantities of concentrated sulfuric acid wastes. The present emergency is expected to again bring about large requirements for lime.

* * * * * * * * * *

Natural and synthetic rubber were among nine products added by the N.P.A. to its list of items that may not be hoarded or sold at black market prices. The new additions bring the anti-hoarding list to around 65 materials which are in short supply.

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Th U.S. aluminum industry produced 19 percent more primary metal in 1950 than in 1949, and plans for this year call for a 20 percent increase in capacity, with still a greater increase scheduled for 1952. However, most of the production will be earmarked for defense orders or for the national stockpile. The 1950 production totaled 1,437,255,518 lb.

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A 15 percent freight-rate increase instead of the 6 percent previously requested is being sought by the Association of American Railroads. Association spokesmen stated that increases in costs and wages would raise the railroad's expenses by more than $950,000,000 above previous estimates. The request for a general 15 percent increase won't apply to certain items for which specific money amounts of freight increases will be sought.

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A rubber drive belt with teeth is being sold to industry by United States Rubber Co. The company claims it is the first commercial application of this sort of belt. Made of rubber and reinforced with steel wire, this belt has teeth on the inner side which fit into grooves on the pulley-like gears. The faults of similar belts which have been attempted. such as stretching and excessive wear on the teeth, are claimed to have been eliminated. The belt will not slip, allows for split-second timing and will operate at rates up to 16,000 ft. per min.

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A total of $3,944,400,000 for engineering construction of all classes for the first 13 weeks of 1951 was 52 percent higher than corresponding contract awards last year, as reported by Engineering News-Record. Private construction was up 71 percent, while public construction was up 28 percent. State and municipal awards were up 27 percent.

* * * * * * * * * *

Automobile accident deaths and injuries in the nation took a sharp jump last year over 1949, according to figures recently released by The Travelers Insurance Company. The report indicates that the 1950 death toll of 35,500 was the greatest since 1941 when 40,000 deaths occurred. The injury total soared to a new all-time high of 1,799,800, displacing the previous high of 1,564,000 in 1949. The 1941 figure was 1,488,000. These statistics are highlights of "R.I.P.," seventeenth in the annual series of traffic safety booklets issued by The Travelers. An adequate highway-building program can go a long way to eliminating contributory causes to many accidents.

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Soda ash, a basic chemical material essential to national defense, is still in short supply, largely due to increased industrial defense activities. Allied Chemical & Dye Corp.'s Solvay Process Division, Syracuse, N. Y., has applied to Washington, D. C., for a certificate of necessity to cover an expansion program that would increase the plant's output of soda ash by 200,000 net tons per year.

THE EDITORS

★ ★ Editor's Page

A Practical Approach to Accident Prevention

ONE OF THE MOST significant developments in industry today is the emphasis being given to public relations and industrial relations. The times have brought about a new concept of doing business, which necessitates that a successful business be conducted so that it will be recognized as desirable by the public and by its employes.

Alert management has come a long way to show its regard for the welfare of worthy employes, through tangible benefits, and to demonstrate that it recognizes its responsibilities to the public. These "social" aspects to doing business are being accepted as obligations that are both desirable and profitable, and wide-awake management is enlarging its activities in those directions. This is as it should be and everyone benefits.

Need for Safety

An extremely important obligation of management is to provide safe working conditions and an atmosphere conducive to the prevention of accidents, but far too little is being accomplished in that endeavor. The poor participation in safety competitions sponsored by the several trade associations in the rock products industries must be taken as evidence that there is not sufficiently wide recognition that stress on safety is necessary.

Most every producer is cost-conscious and is intensely interested in new ideas about plant operation. In interchanging ideas to improve plant efficiency he is dealing with something tangible that may be approached mechanically and the results show up in black and white on the cost sheet.

If safety could be presented in a similar light to production problems there would no doubt be a greater interest shown in doing something about it.

There is no question that everyone hates to see accidents and that there is agreement with all the arguments set forth in crusades by safety experts to eliminate accidents. After all, there is the humanitarian angle, and great savings to be made in the face of legislative trends establishing laws that make accidents more expensive.

Sometimes we think that too many lecturers on the subject of accident prevention are inclined to deal too much in generalities, with the result that hard-headed practical men are unimpressed. We have seen top operating men walk out on meetings for that reason.

A big part of the answer is in capitalizing on the close tie that exists in the relationship between safety and production. It has been proven that the safe plant is the most efficient operation, and that fact alone should be sufficient to stimulate greater interest in accident prevention.

Group Meetings

An article in this issue by C. A. Gustafson, superintendent of a crushed stone operation, tells how regional safety meetings are held in his area. Visits to plants by executives and key operating men, as conducted for the purpose of detecting hazards and discussing them, strike us as having great value.

These visits are planned to permit detailed study of the drilling and blasting operations, excavation and other phases of production in various plants throughout a limited region. Then follows a round-table discussion of danger spots as observed and they are brought to the attention of management.

All of us are prone to overlook shortcomings in what we ourselves do but others can quickly detect them, and that is what is happening in these group inspections. The guy who thinks he has everything under control soon learns that there are many serious hazards existing right under his nose that require immediate correction.

When a group of men interested in production get together in a plant representative of their own industry, the natural outcome is a swapping of ideas on most any phase of safety and production. These meetings have developed into "operating sessions" that have stimulated a great desire to exchange experiences in plant operations as well as safety.

Producers are urged to consider the organization of similar meetings in their areas and to accept the invitation of the author of the article on safety in this issue, who desires to stimulate the group idea in other areas.

His plan is an effective way to gain the backing and enthusiasm of top management, which is absolutely essential to success of any safety program. Through the group meeting idea, that kind of spirit can be built which was reflected in a recent letter from the president of a sand and gravel company with an outstanding safety record. In acknowledging receipt of a safety trophy awarded by ROCK PRODUCTS, he wrote, "The men proudly received the trophy. Sorry you could not have been present to see the enthusiasm of the men when they received it."

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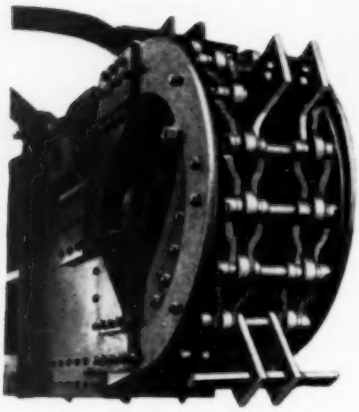

Eagle "*Swintek*" Dredging Ladder "LEAVES NO STONE UNTURNED" to *INCREASE* PROFITS!

THREE dredges owned by Blue River Sand & Gravel Co., Irving, Kan., all equipped with Eagle "Swintek" Dredging Ladders, are shown. They report that production was tripled! The Blue River abounds in rocks. Shut-downs, caused by rocks in suction lines, were frequent before the "Swinteks" were installed. Also, the ratio of solids to water pumped was greatly increased because of the agitation of sand and gravel in the pumping zone. The cutter bars mounted at intervals on the screening chain of the "Swintek" really stir things up. Where clay strata are encountered the "Swintek" chews through to get at the sand.

Blue River Sand & Gravel installed a 10″ - 35′ Swintek Ladder in 1944. It is shown working just north of Blue Rapids, Kan. A second unit—a 10″ - 40′ "Swintek" was installed in 1945. It is shown working in the Blue River south of Irving, Kansas. The third unit installed in 1946—a 10″ - 30′ "Swintek"—is shown operating in the Blue River just south of Blue Rapids. All three are light duty models and all three dredges have 8″ Amsco Dredge Pumps with 10″ suction line and 8″ discharge. Bulletin 745 tells the whole "Swintek" profit story.

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Rocky's NOTES

Nathan C. Rockwood

Crystallography for Study of Concrete

GOOD "OLD" CONCRETE is described as "dense with crystalline structure or appearance," while poor concrete is described as "chalky." Was the cement in the old concrete crystalline because of unhydrated or anhydrous cement particles, or does all portland cement become crystalline with age? Does the chalky or amorphous character of some more recent concrete mean that it is more completely hydrated, and therefore always will remain amorphous or of a solidified gel composition? How does one go about producing a crystalline mineral structure, assuming that is the end product of a good cementing material? It seems to us answers to these questions are within grasp of inorganic chemists, physical and colloid scientists or geochemists familiar with mineralogy in all its branches.

In truly amorphous or gel structure the atoms or ions (extremely small particles composing it) are supposed to be randomly placed. They cannot be photographed and identified by X-rays. In crystals, on the other hand, they are organized in patterns that can be identified, and the arrangement follows laws of grouping that are known and studied. The minerals in portland cement clinker have been studied and identified, but in cement completely hydrated it is reported difficult or impossible to identify positively anything but crystals of calcium hydroxide, sulfate and carbonate, and unhydrated clinker particles. Autoclaving results in formation of identifiable crystals of silicates and aluminates.

Methods of Crystallizing

In order for chemical and physical forces to cause atoms or ions to arrange themselves in systematic grouping, these tiny particles must be given mobility. This can be done in at least three ways: (1) by application of heat; (2) by putting them into a solution, either chemical or colloidal; (3) by a combination of both or hydrothermal processes. The manufacture of cement clinker is an example of the first. The rearrangement of atoms or ions of raw materials is given enough mobility to regroup by raising temperatures to some 2000 deg. F. The process is facilitated by melting, but calcination of hydraulic lime and natural cement proves that actual melting of ingredients is not essential. A quickly chilled melt becomes a glass, which does not crystallize. Hydrothermal reactions have the benefit of both heat and solution. A practical application is the sand-lime brick process and high-pressure steam curing of concrete products. There are probably other methods in Nature by which crystal structures are formed, rearranged, built up and disintegrated. Perhaps there are elements, or ions, which act as catalysts or promoters of crystallization.

Crystallography

Crystallography or optical mineralogy is the study of mineral crystals in order to identify them with a microscope by the kind of grouping of the elements or ions. Like every other science related to chemistry there has been tremendous progress in the last score years. A new book on the subject which we believe makes an excellent companion volume to the one on geochemistry, reviewed in our February issue of ROCK PRODUCTS is "Elements of Optical Mineralogy,* Part II—Descriptions of Minerals"—by Dr. Alexander N. Winchell, University of Wisconsin, and Dr. Horace Winchell, Yale University.

Having little acquaintance with the science of crystallography, we can review this volume only as a layman, and point out some things that may be of interest to other laymen. Believing as we do that future progress in cement and concrete research will be made through application of geochemistry, it goes without saying that this textbook is a necessity if the researcher wants to find out what he has. That obviously is the first step in finding out how it got that way and by what kind of ingredients or processing one may get something different or better in the way of a crystal organization.

The Silicates

Since the good qualities of portland cement are universally attributed to calcium silicates resulting from hydration of clinker, which has been proved to be essentially anhydrous calcium silicates, the problem is what kind of silicate crystals are possible in cement hydrated without benefit of hydrothermal reactions. About half of this book is devoted to the Silicates, how they occur, where, and how the crystal grouping is arranged in each. The Silicates are by far the largest mineral species in Nature, and since nearly all the other mineral elements may be captured and held in silica frameworks, the number and variety of these minerals, based on chemical analyses, is extremely large and complex. They are readily classified by the way the silica tetrahedrons are grouped or joined into six varieties: (1) single tetrahedrons, not joined together at all; (2) groups with a single linkage between the silica tetrahedrons; (3) groups in which the silica tetrahedrons are in rings with two linkages between each tetrahedron; (4) chains of tetrahedrons with two linkages each; (5) sheets of tetrahedrons with three linkages each; (6) three-dimensional frameworks with four linkages, of which the chemical formula is SiO_2 or quartz. Chemical formulas are now written so that the kind of linkage is made clear, and diagrams illustrating these silica tetrahedron linkages are most interesting, even to a layman.

It appears from the catalog of Silicates that while calcium is a constituent of many, it is extremely rare as the sole constituent. It is most commonly associated with aluminum, apparently because aluminum can substitute for silicon in part of the tetrahedra. When that happens, the aluminum atom or ion having a valence or positive electrical charge of only three against silicon's charge of four, other positively charged atoms or ions are required to balance or neutralize the crystal lattice or framework. It may be, therefore, that pure calcium silicates are rare in Nature because it is not possible to form a permanently stable crystalline silicate with calcium alone.

In this respect calcium differs from magnesium, for magnesium silicates are fairly common—forsterite (Mg_2SiO_4) for example. It is what is termed a Nesosilicate, or the kind in which the silica tetrahedrons are single with no linkages to adjoining ones. These are the strongest, most durable kind of silicates. According to the chemical terms used in portland cement analyses, the formula for forsterite would be $2MgO.SiO_2$. It would seem then that the prejudice against magnesium in portland cements is based on the fact that it is not properly combined, or processed, to make a binder more durable than $2CaO.SiO_2$. Anhydrous dicalcium silicate does not appear to exist in Nature; but only in unstable cement clinker and furnace slags. There are a few natural hydrous or hydrated calcium silicates, as books

(Continued on page 104)

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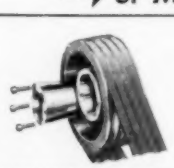
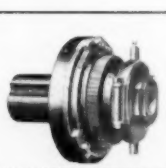


V-BELTS AND TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS



ROLLING GRIP AND DIAMOND D CLUTCHES

SOLID STEEL CONVEYOR PULLEYS

LABOR RELATIONS TRENDS

All Government Purchases of Agstone May Come Under Public Contracts Act

By NATHAN C. ROCKWOOD

A CASE IN WHICH A PURCHASE of less than $10,000 worth of agricultural limestone negotiated under the Agricultural Conservation Program has been held to come under the Walsh-Healey Public Contracts Act was decided by the administrator of the Act on February 14. The Walsh-Healey Act is even tougher on producers than the Fair Labor Standards Act because it sets an 8-hour day, regardless of the 40-hour week, as the limit beyond which overtime must be paid. Nor is the minimum wage that is established by the Fair Labor Standards Act applicable, but "the prevailing local wage" as determined by the Labor Department, which is invariably more. In addition the producer must pay an amount equal to that due his employes for overtime to the federal government as liquidated damages, and he is blacklisted so he can not get further government business. The minimum contract limit for application of the Walsh-Healey Act is stated in the law to be $10,000.

The case reported here involved a small limestone producer in the Southwest. The original report was made by an examiner of the Labor Department which has jurisdiction over the enforcement of the Walsh-Healey Act. The producer appealed for a review of the examiner's ruling by the administrator of the Act, McComb. His decision, upholding the examiner, reads in part as follows:

"The record establishes the following facts: Six contracts were made between respondent [producer] and the United States Department of Agriculture by that Department's acceptance of bids submitted by respondent in answer to the Department's invitations, to furnish agricultural ground limestone at the contract price per ton in such quantities as might be required to fill farmers' requests under the Agricultural Conservation Program. Each contract covered a period of approximately one year, and all of them together covered the period from November 23, 1945, the date of award of the first contract, to August 3, 1948, the date of inspection by the Public Contracts Division [of the U. S. Labor Department]. The violations occurred between the week ending March 6, 1946, and July 31, 1948.

"Each of the contracts specified the 'approximate tons' of limestone to be furnished and the price to be paid the contractor. Each contract contained a clause relating to the Public Contracts Act and incorporated either in text or by reference the representations and stipulations required by the Act.

Producer's Defense

"The respondent [producer] asserts that the decision of the hearing examiner was erroneous in two respects:

"1. Respondent alleges error by the examiner on the ground that the Public Contracts Act is not applicable to these contracts inasmuch as the agreements were not valid and enforceable contracts, but only unilateral writings lacking the mutuality of obligation necessary to create a binding contract.

"2. Respondent claims that these writings merely designate the respondent as a source of supply of agricultural ground limestone for the area, and because the agreements did not specifically commit the Government to buy a fixed and definite quantity of limestone, they are unenforceable for lack of consideration. Respondent argues that 'there being no definite sum concerned either in excess of or less than $10,000, the respondent was not subject to the provisions of the Walsh-Healy Public Contracts Act.'

"With regard to the statements that the purpose of the contracts was 'to establish sources of supply' I can not see that this fact would show an intent to create a relationship other than a contractual one. The purpose of any supply contract is to establish a source of supply, and such purpose is entirely compatible with an intention to enter a valid, binding contract.

"With regard to respondent's assertion that the agreements lacked the mutuality of obligation necessary to the creation of a binding contract, it is certainly true that at the time these agreements were entered into no fixed and definite obligation was undertaken by the government other than the obligation to pay at the contract price, for the limestone which the contractor might furnish under the contract. Although the government was not required by the terms of the agreement to purchase definite quantities of limestone, the fact is that quantities of limestone were furnished by the respondent and paid for by the government in accordance with the terms of the contract.

"It is a well established principle of contract law that an executory contract which lacks consideration is made valid and binding by performance. * * * * [Legal references].

Specific Amount Not Required

"In the case at hand the record shows that the parties intended to commit each other to a course of mutual dealing for the furnishing of a specified commodity. In pursuance thereof they executed formal agreements to govern their dealings and treated such agreements as binding. In administration of the Public Contracts Act it has been the position of the Public Contracts Division that the Secretary of Labor is bound, in the performance of his duties, to look to the essence of such agreements to determine whether they are, from a practical standpoint, contracts in the sense that they govern procurements of a kind to which the Act was intended to apply, rather than to technical considerations of contract law as they may prevail in any of the jurisdictions in which such contracts may be made. Accordingly, it has been repeatedly held that for purposes of the Act, 'the argument that such an agreement is not binding at its inception is not material where it appears that the parties later conducted themselves under its terms as if such agreement were binding and where the original agreement itself contemplated the manufacture or furnishing of goods or the performance of work in accordance with the terms and conditions specified therein.'

"Upon the basis of the considerations expressed above it is my opinion that the agreements in question formed the basis for performance of the specified work and were contracts as contemplated by the Act.

"With regard to respondent's contention that the absence of a specified contractual amount in excess of $10,000 rendered the Public Contracts Act inapplicable, it may be pointed out that the regulations adopted by the Secretary of Labor pursuant to the Act require insertion of the Public Contracts Act representations and stipulations in all contracts which may exceed $10,000 unless the contracting officer knows in advance that the total amount will not exceed $10,000 in any event. * * * *

"It seems clear that the question of the application of the Act to a contract must be determined at the time the contract is entered into. An affirmative determination having been made by the contracting officer and the stipulation inserted in the contract, the contractor has an obligation to comply with those stipulations from the beginning of the work on the contract. He can not withhold compliance with the stipulations until after he has performed more than $10,000 worth of work. * * * * Consequently, it has been consistently held that where there is an expectation that purchases under a contract will exceed $10,000, the Act is applicable to such contract, even in the event that the value of goods actually furnished under the contract falls short of $10,000.

"I must therefore hold that the absence of a specified amount in excess of $10,000 did not render the Public Contracts Act inapplicable to the contracts with which we are here concerned.

(Continued on page 106)

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the *Personal Side* of the news

His Hobby is Photography

WILLIAM W. CRAPO, secretary, assistant treasurer and director of the Huron Portland Cement Co., Detroit, Mich., and the Huron Transportation Co., a subsidiary, is an accomplished photographer and is responsible for

Mr. and Mrs. Wm. W. Crapo, who are regular attendants at industry conventions

some of the more excellent pictures that have appeared in recent issues of ROCK PRODUCTS. As one of ROCK PRODUCTS' long-time subscribers, we are urging him to continue to contribute illustrations of interest to our readers for future publication. He also is an "official" photographer for the *American Hereford Journal* and the *Michigan Farmer*. This is one of many hobbies and interests of Mr. Crapo who is engaged in many other activities outside the portland cement industry and his affiliations in other rock products industries.

Born in Saginaw, Mich., and a resident of Detroit since 1900, Mr. Crapo graduated from Yale University with a B.A. (honoris causa) degree and attended short courses at Michigan State College, Artillery Officers Training Schools and night schools. After service in Army training camps in U. S. and overseas duty at the front in three major offensives during World War I, he became overseer and later manager of 1500-acre Crapo Farm, Swartz Creek, Mich., which he now owns, and where the world's oldest herd of registered Hereford cattle has been maintained by one family continuously on one farm, with the exception of the Hill and Moore herds in England. He left the farm in 1922 to become associated with the Huron Portland Cement Co., first at the plant in Alpena, Mich., and then at the general offices in Detroit, where he subsequently became secretary, assistant treasurer and director. His interest in the farm continues to be rivalled only by his hobby of photography.

Mr. Crapo also is a director of the Second National Bank and Trust Co. of Saginaw, Mich., the Bad Axe Grain Co. and Wallace & Morley (grain elevators), and vice-president and director of the Cadillac Soo Lumber Co.

He is a member of the National Association of Manufacturers, Portland Cement Association, United States Chamber of Commerce, Economic Club, Engineering Society, Board of Commerce, Propellor Club, Historical Society, Convention and Tourist Bureau, National Association of Cost Accountants, American Ordnance Association, Citizens League, Housing and Planning. His club affiliations include the Detroit Club, Country Club of Detroit, University Club, Boat Club, Saginaw Club, and Yale Club of Boston.

A strong Republican, he was chairman of the delegates from the 14th Congressional District State Convention at Grand Rapids in 1949. He is a member of the 15-man executive committee of the 14th Congressional District. Mr. Crapo's interest in government has been family tradition. His grandfather, William W. Crapo, was a congressman; his great-grandfather, Henry W. Crapo, was governor of Michigan during part of the Civil War; and his father, Stanford T. Crapo, director of the Federal Reserve Bank of Chicago, held semi-political positions of trust. The name "Crapo" adorns city streets in Flint, Saginaw, and Alpena, Mich., and the largest cement ship of the Huron Transportation Co.

Chairman of the Board

A. W. DANN, executive vice-president of Dravo Corp., Pittsburgh, Penn., has been elected chairman of the board of the Union Barge Corp., a subsidiary. He was formerly president and will be succeeded in this position by Alfred S. Osbourne. Lowell French has been named executive vice-president; Lawrence M. Baker, secretary; William E. Clark, director and member of the executive committee; and Clifford A. Hill, director. Mr. Dann is past-president of the National Sand and Gravel Association, and was the head of the former Keystone sand and gravel division of Dravo Corp.

District Engineer

JOHN H. GOSHORN, formerly assistant chief engineer of the Ohio State Testing and Research Laboratory, has been appointed district engineer of The Asphalt Institute, New York, N. Y., covering the territory included in the states of Ohio, Indiana, Michigan, Kentucky and West Virginia, with headquarters in Cincinnati, Ohio. Albert H. Hinkle, senior engineer in years of service on the district engineering staff, has been promoted to the rank of division engineer. After receiving a B. S. degree from Manchester College, North Manchester, Ind., in 1925, Mr. Goshorn continued postgraduate work in the Department of Chemistry at Ohio State University and served as graduate assistant in the department. In 1926 he joined the Ohio State Testing and Research Laboratory as chief chemist and subsequently became assistant chief engineer, which position he has held a number of years.

Research Director

DR. GEORGE E. ZIEGLER has been named research director for the Zonolite Co., Chicago, Ill. He has been director of research for the Midwest Research Institute, Kansas City, Mo.,

Dr. George E. Ziegler

since 1948. He joined the Institute as executive scientist in 1945. Previously Dr. Ziegler was chairman of physics research at Armour Research Foundation of Illinois Institute of Technology, Chicago. During World War II he directed defense research programs for the government, and was awarded the certificate of merit by the Office of Scientific Research and Development.

Re-elected President

MERRILL ALLEN has been re-elected president of the Watertown Cement Products Co., Watertown, S. D. Vince Halverson has been re-elected vice-president, and Harvey Werner, secretary-treasurer.

Business Leader

FRED A. MANSKE, recently appointed vice-president in charge of manufacturing for the National Gypsum Co., Buffalo, N. Y., is a man of quiet ability and apparently inexhaustible energy. His climb to one of the topmost rungs of the business ladder was neither rapid nor phenomenal. He has brought tireless energy to a steady succession of various exacting and laborious assignments, and all who do business with him find him modest, sincere, logical and direct in his approach to a problem.

Born in Chicago, Ill., Mr. Manske grew up in the Edgewater and Ravenswood sections of that city. He was educated in Chicago public schools and entered the Armour Institute of Technology where he majored in mechanical engineering, graduating with a B.S. degree in 1923. He paid for most of his own education. He started out delivering newspapers, gradually expanding the route until he had three boys working for him. He used the same technique in developing a handbill business. At first he peddled them himself. Later on he convinced several big stores to give him the job of supervising their distribution through a group of youngsters. Never one to wait for opportunity to come pounding at his door, he was a full-fledged bill collector by the time he was 16.

While in college, he worked for the school of engineering, grading physics papers and setting up laboratory equipment. Later he became student assistant to Dr. Frank Gunsaulis, president and founder of Armour Institute. After leaving college, Mr. Manske entered the gypsum industry as a sales correspondent. Two years later he was chief correspondent for the eastern sales division. Then he became a field market supervisor for new and specialty products, traveling around the country supplying technical assistance to architects, salesmen and contractors. As a research engineer he devoted his efforts to developing new and improved products, systems of construction and methods of manufacture.

Mr. Manske joined the National Gypsum Co. in 1934 as assistant to Gordon H. Tarbell, vice-president in charge of operations. His decision to become a part of the young, aggressive company resulted from his meeting with Melvin H. Baker, president, during the building of the Chicago World's Fair. In 1936 Mr. Manske was named production manager in charge of eight plants, which later was increased to 12 plants. In 1949 he was appointed general production manager in charge of 22 plants and the quarries at Dingwall, Nova Scotia. As vice-president in charge of manufacturing, Mr. Manske is confronted daily with vast and complex problems which he meets with quiet fortitude. Coming up from the ranks himself, he believes in promoting qualified men from within the organization and extends them complete confidence.

Road Builders Elect Officers

PAUL B. REINHOLD, president of Atlas Equipment Corp., Pittsburgh, Penn., was elected president of the American Road Builders' Association at the 48th annual association meeting, held March 12-14, 1951. Mr. Reinhold succeeds Col. Enoch R. Needles, New York consulting engineer.

Serving with Mr. Reinhold, as district vice-presidents, will be Charles M. Noble, chief engineer, New Jersey Turnpike Authority, Trenton, N. J., *Northeastern;* Charles W. Smith, president, Smith Engineering and Construction Co., Pensacola, Fla., *Southern;* W. A. Roberts, president, Allis-Chalmers Mfg. Co., Milwaukee, Wis., *Central;* and A. Diefendorf, head, Dept. of Civil Engineering, University of Utah, Salt Lake City, Utah, *Western.* Jennings Randolph, assistant to the president of Capital Airlines, Inc., Washington, D. C., and former West Virginia congressman, was renamed treasurer.

A.R.B.A.'s manufacturers' division, the Construction Industry Manufacturers Association, elected the following officers and directors:

Julien R. Steelman, vice-president, Koehring Co., Milwaukee, president; H. T. Reishus, general manager, industrial division, International Harvester Co., Melrose Park, Ill., first vice-president; C. F. Boyd, vice-president, Galion Iron Works & Mfg. Co., Galion, Ohio, second vice-president; R. E. McCluskey, vice-president, R. G. LeTourneau, Inc., Peoria, Ill., secretary-treasurer; Harold F. Hess, Chicago, executive vice-president.

Directors elected for three-year terms are: E. Scranton Gillette, president, Gillette Publishing Co., Chicago; Joseph F. Heil, president, Heil Co., Milwaukee; C. J. Haring, general sales manager, J. D. Adams Mfg. Co., Indianapolis; O. J. Neslage, vice-president, Joy Mfg. Co., Pittsburgh; L. G. Schraub, vice-president, Union Wire Rope Corp., Kansas City, Mo., and Mr. Reishus and Mr. McCluskey.

U.S.D.A. Official

GEORGE CHRISTOPHER, Bates county farmer and former Congressman from the 6th Missouri District, has been given an assignment in the U. S. Department of Agriculture, Washington, D. C., as one of the top men in soil conservation. One of his major duties is personal contact work with State PMA Committees on administration of soil conservation. He will also serve as a liaison officer between the U. S. Department of Agriculture and the Congress on soil conservation matters.

Chemical Engineer

MARVIN FIELDS, graduate of the University of Kansas, has been appointed chemical engineer at the new Medicine Lodge, Kansas, gypsum plant of the National Gypsum Co., Buffalo, N. Y. Lawrence Garfield, Colorado School of Mines graduate, has been named mine foreman, and Tom Smith, University of Oklahoma, has been made sales supervisor.

Haakon Paulson, distribution manager for Besser Manufacturing Co., promotes modular dimensioning of concrete building units whether he's on the job or not. His "modular-conscious" mind has conjured up a 24-in. (six modules) frying pan for making modular hamburgers when entertaining his friends at his home in Alpena, Mich. Capacity of this unusual frying pan is 24 hamburgers or four 8-in. T-bone steaks, plus onions and mushrooms

Started as Billing Clerk

GLENN R. LEAMAN, assistant secretary and assistant treasurer of the Northwestern States Portland Cement Co., Mason City, Iowa, started with the firm as a billing clerk back in 1921 when Clarence Hanson was appointed assistant sales manager. Born on a farm near Allison, Iowa, Mr. Leaman's family moved to Mason City when he was nine years old. He attended public schools there and entered Iowa State College in 1918 to study mechanical engineering. His college studies were interrupted by World War I when the student army training corps at Ames enlisted him as chief clerk. After the war he returned to Mason City without completing college and joined the Goodrich agency there. When the branch closed he worked a few months at the Decker plant before joining Northwestern States Portland Cement Co.

Ideal Changes

H. B. BOLTON has been appointed Gulf regional sales manager of the Alabama, Louisiana, Arkansas and Gulf divisions of the Ideal Cement Co., Denver, Colo., with headquarters in Mobile, Ala. He was formerly sales manager of the Alabama division and will be succeeded in this position by W. J. Conway, who was assistant sales manager of the division. Charles L. Hebert, formerly assistant sales manager of the Alabama Division, has been named assistant to the Gulf regional sales manager, with headquarters in Baton Rouge, La., and H. H. Howle, formerly a salesman in the Alabama division, Hattiesburg, Miss., has been appointed assistant sales manager of the Alabama division in New Orleans, La.

On Technical Staff

KENNETH E. KOEHLER has joined the technical staff of the Concrete Products Association of Washington, Seattle, Wash., as a registered architect. A graduate of the School of Architecture at the University of Illinois, Mr. Koehler for the past three years has been engaged in architecture in Seattle. Prior to that he worked and studied under architects of the Midwest for five years. According to C. M. Howard, engineer for the association, Mr. Koehler will be available to give advice on the best use of concrete products, as well as to develop new uses and improvements.

Vice-President Resigns

R. FRANK ATKINSON has resigned as vice-president and general manager of the W. H. Loomis Talc Corp., Gouverneur, N. Y., after 25 years of service with the company. F. A. McGonigle of Nickelplate, B. C., has been appointed to succeed Mr. Atkinson as general manager.

OBITUARIES

CHARLES LEWIS CARMAN, widely known cement engineer, passed away at his home in Pasadena, Calif., March 27. He was 92 years old. Born in Madison, Wis., and a graduate of the University of Wisconsin, Mr. Carman started his business career with the Eclipse Wind Mill Co., Beloit, Wis., as a mechanic and as a draftsman. Later he joined the old Gates Iron Works in Chicago where he was soon made chief engineer. In this capacity he developed the entire Gates line of cement, mining, and crushing machinery and was granted various patents. He had on his staff such outstanding cement machinery engineers as A. B. Shiflin and Paul C. Van Zandt, who later headed the cement machinery department of Allis-Chalmers Manufacturing Co., and Richard Bernhard, who was chief engineer for the Traylor Engineering Co.

Among the machines designed and patented by Mr. Carman were the Gates and Austin gyratory crushers, Kennedy-Van Saun gearless crusher, and the Carman ball classifying liner plate. Many of the earlier portland cement plants in the United States were designed by Mr. Carman and his staff while he was with the Gates Iron Works. He assisted in the development of the process for the manufacture of portland cement from limestone and blast furnace slag at the old North Works of the Illinois Steel Corp.

When the Gates Iron Works was sold and became a part of Allis-Chalmers Manufacturing Co., Mr. Carman left the cement machinery manufacturing industry and entered the consulting engineering field. In this capacity he designed the original Alpha No. 4 plant at Martins Creek, Penn., and the original Riverside Portland Cement Co. plant near Riverside, Calif. The late William B. Newberry was one of Mr. Carman's staff on the Alpha plant. At the Riverside plant he worked closely with Walter Schmidt, founder of the Western Precipitation Corp., in the development and installation of the first Cottrell electric precipitator for the portland cement industry.

Mr. Carman also remodeled and modernized many of the earlier portland cement plants, such as the plant at Portland, Colo., the Oro Grande, Calif., plant of Riverside Portland Cement Co.; the Oglesby, Ill., plant of the Chicago Portland Cement Co., then owned by Norman D. Fraser and now owned by Lehigh Portland Cement Co. He designed the original plant at Hermosillo, Mexico, for MacDonald Engineering Co., and was personal consulting engineer for the late Carl Leonhardt, president of the Southwestern Portland Cement Co.

In 1941 Mr. Carman retired from active consulting work and established his permanent home in Pasadena, Calif. Even in his retirement he continued to devote much of his time to the development of new and better machinery for the manufacture of portland cement.

DONALD D. REYNOLDS, vice-president, Boston Sand and Gravel Co., Cambridge, Mass., and a member of the board of directors and the executive committee of the National Sand and Gravel Association, died suddenly of a heart attack on March 25, while skiing with his two young sons. He had apparently been in the best of health. A graduate of Harvard University, Mr. Reynolds spent most of his adult years with the Boston Sand and Gravel Company. He attended the New Orleans convention of the National Sand and Gravel Association in February.

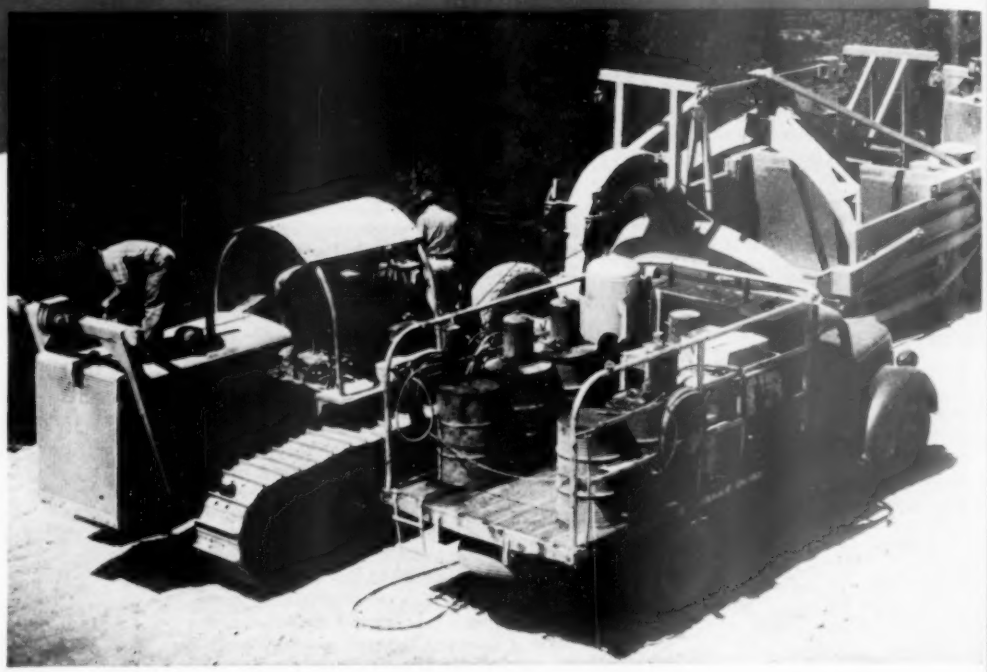
CLARK B. NICHOLSON, retired sales manager of the Bellefonte Lime and Stone Co., Bellefonte, Penn., passed away April 2 in Miami, Fla., where he had resided for the past 24 years. He was 92 years old.

PATRICK SULLIVAN, former owner and operator of stone quarries in Kansas City, Mo., died April 1 at the age of 94. Born in County Kerry, Ireland, Mr. Sullivan had been a resident of Kansas City for 68 years.

HOWARD C. MEANS, noted Utah engineer and former chief engineer of the Utah State Road Commission, passed away March 19 after a long illness. He was 75 years old. As chief engineer, Mr. Means had charge of all construction and maintenance of 3300 miles of highway. Among the engineering projects for which he is best known are the irrigation systems on the Crow and Cheyenne reservations in Montana, Shoshone reservation in Wyoming, and Uintah reservation in Utah; formation and construction facilities of the Uintah Power and Light Co., and construction of Mt. Carmel Highway in Zion National Park. For five years he was with the Uintah Power and Light Co., designing and building the power plant and lines and operating a subsidiary milling business, of which he was president, manager and engineer. In 1921 he organized the H. C. Means Investment Co., and five years later became field examining engineer for Midwest Power Co. He was also secretary-treasurer of the Woolf Petroleum Co., Calpet, Wyoming, a position he held until his death. He was manager and engineer for the Utah Rock and Asphalt Co., and in 1932 became president and manager of the successor company, the Rock Asphalt Co., Salt Lake City, Utah.

WILLIAM G. MATHER, a director of The Kelley Lime and Transport Co., and the Medusa Portland Cement Co., Cleveland, Ohio, died April 5 at the age of 93.

KEEP YOUR EQUIPMENT ON THE JOB



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INDUSTRY *news*

Ideal's Expansion Program

IDEAL CEMENT CO., Denver, Colo., has announced that the new finish grinding mill at Trident, Mont., is nearing completion and is expected to be in operation soon. This installation, which is part of a $6,000,000 expansion and improvement program, is expected to enable a production increase of about 50 percent at this plant.

"Soil-Fertility" Meeting

RIDDLE QUARRIES, INC., sponsored a "Soil-Fertility Day" in Marion, Kan., March 3. Dr. Harold E. Myers, agronomist at Kansas State College, discussed "The Importance of Lime in Our Soils." Dr. H. J. Harper, agronomist at Oklahoma A & M College, spoke on "Rock Phosphate in Our Soil Fertility Program."

Cover Picture

COVER PICTURE on this issue shows the fifth kiln (left) installed alongside the four other kilns at Permanente Cement Co.'s plant at Permanente, Calif. Installation of the new kiln has increased production by 25 percent, increasing plant capacity to 7,000,000 bbl. per year. Yet, despite this increase, demand is far outstripping the expanded capacity. Completion of the fifth kiln and other equipment cost approximately $3,500,000 and were paid for entirely out of company funds, with no outside financing. In addition to the kiln, additional slurry storage tanks and grinding mills have been added to handle the increased requirement of raw materials. Additions also were made to the plant's Cottrell stack dust collectors.

Other company expansions include enlarging storage facilities by 37½ percent at Seattle, Wash., the forwarding point for cement used in Alaska's military construction program, and for supplying the defense and commercial requirements of the Washington-British Columbia area. Storage facilities are being boosted from 80,000 to 110,000 bbl.

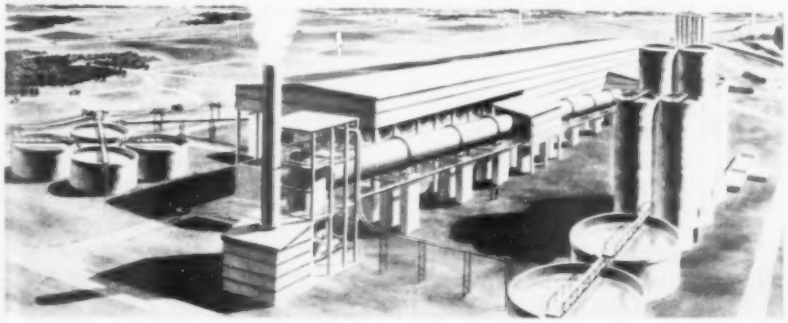
Recently completed bulk cement distribution facilities at Anchorage—Alaska's first—and Fairbanks are enabling Permanente to accelerate defense construction in that key territory.

Permanente maintains distribution facilities at Redwood City, Calif.; Portland, Ore.; Seattle, Wash.; Honolulu; and Anchorage and Fairbanks, Alaska. Redwood City is the home port for company-owned bulk-carrier steamships carrying cement to the other points.

Percentage Depletion

NATIONAL INDUSTRIAL SAND ASSOCIATION is continuing its efforts to secure percentage depletion in collaboration with the National Sand and Gravel Association.

The Ways and Means Committee, in considering the new 1951 Revenue Law, had indicated it would receive testimony on percentage depletion. Accordingly, on March 5, 1951, J. Rutledge Hill, chairman of the Committee on Taxation of N.S.G.A., and Charles E. Brady, vice-chairman, submitted statements to the Ways and Means Committee. Both witnesses were accorded a sympathetic and courteous reception by the committee and several members asked questions which helped point out favorable aspects of the case. Mr. Hill stated that his recommendation for a percentage depletion allowance of 15 percent included industrial sand as well as sand and gravel. Since both industries depend upon rapidly wasting assets, the associations feel they have a good case for percentage depletion.



Artist's conception of Marquette Cement Manufacturing Co.'s new 1,000,000-bbl. per year cement plant now under construction at Brandon, Miss., as it will appear when completed this fall

Construction "Firsts"

GREAT LAKES CARBON CORP., New York, N. Y., producer of perlite, states that the new Sinclair Oil building in New York City is the first skyscraper in New York City to use perlite plaster throughout. The company stated that by fireproofing the steel beams in the building with a perlite-plaster suspended ceiling, a tremendous saving in dead weight has been effected. This dead-weight saving results from the fact that these steel beams would be encased in solid concrete if built according to conventional methods. It was estimated by the company that a dead-weight saving of 200 lb. per lineal foot of 18-in. beam was effected by the use of perlite plaster fireproofing and that this weight saving is approximately 10 percent of the carrying capacity of an 18-in. beam on a 25-ft. span.

Consolidated Soil Conservation Services

CHARLES F. BRANNAN, secretary of agriculture, recently announced the reorganization of the conservation activities of the U. S. Department of Agriculture. The agricultural conservation resources services of U.S.D.A. is now under the supervision and direction of the assistant secretary of agriculture, designated for this activity. The reorganization includes the conservation programs of the Forest Service, Soil Conservation Service and the Agricultural Conservation Program of the Production and Marketing Administration.

Under the new setup, all conservation policies and programs of the department, in each state, will be decided upon jointly by P.M.A., S.C.S. and Forest Service officials, with assistance from cooperating state colleges and other designated state agencies concerned with soil conservation.

Mr. Brannan stated that these changes seek to carry out the objectives of the Hoover Commission as they pertain to soil conservation. Also, he felt that the new setup would assure the nation more soil conservation per appropriated dollar and a stronger defense mobilization facility. At the same time, he announced a coordination of all agricultural research services and a reorientation of department agencies for agricultural mobilization purposes, thereby establishing an Agricultural Mobilization Policy Board and Agricultural Mobilization Committees at the national, state and county levels.

Buys Limestone Plant

C. E. McGUIRE, former superintendent of McClinton Brothers Quarries, Johnson, Ark., has purchased the Lily White Lime Co., Rogers, Ark., from Charles L. Key. New equipment is being installed which will increase plant capacity by approximately 50 percent. The plant will specialize in the production of agricultural limestone, but will also produce concrete materials and road materials. Two trucks are operated for the spreading of limestone and another is to be added soon.

Company Shares Profits With Employes

HARRY T. CAMPBELL SONS' CORP., Towson, Md., in observance of its 60th anniversary, will award more than 10,000 shares, or approximately $254,000 of its preferred stock to 348 company employes. This is the second time the corporation has shared company profits with its employes through the distribution of preferred stock, the first time being in December, 1941, when the corporation celebrated its 50th anniversary.

The stock which the 348 employes will receive is 6 percent non-cumulative preferred stock. Employes who have been with the company prior to December 31, 1948, each will receive a number of shares based upon such factors as length of service and nature of work performed.

In a letter to employes, Bruce S. Campbell, president, explained the award of the stock to employes, saying:

"The year 1951 marks our 60th anniversary. During the period which has elapsed since 1941, when we previously distributed preferred stock to our employes, the company has grown substantially and greatly increased the number of its employes. We realize that the success of the corporation is due in a large measure to the loyal services contributed by our employes; and we feel that many who have come with us in the last ten years should share in the earnings as well as our older employes."

Mr. Campbell stated that the preferred stock issued in 1941 has paid a 6-percent dividend every year since that date, and pointed out the fact that the stock presently being distributed will be the same type as previously issued, and the company hopes to keep up its record of paying the dividend on this stock each December 15.

Harry T. Campbell Sons' Corp. was founded in 1892 by Harry T. Campbell, who opened a small quarry on Harford Road and, shortly thereafter, started to produce crushed stone for the new electric carline then being built from Baltimore to Lauraville. Today, the corporation employs approximately 500 people and has a yearly payroll of well over $1,000,000. Besides crushed stone, building stone, gravel, sand, and transit-mixed concrete are also produced. The company also ships a large tonnage of limestone and calcite products to paint, rubber, paper, fertilizer, agricultural, linoleum and other industries.

Four years ago, the corporation embarked in a new field and started the production of "Sakrete," a dry-mixed concrete put up in paper sacks for use on small jobs and for the home owner. The product is now being distributed through over 7000 dealers along the eastern seaboard. A new plant is now being built in Farmington, Conn. This will be the third Sakrete plant and it is expected to be in operation by June 1, 1951.

Bruce S. Campbell, president, has been a partner in the firm since 1908; H. Guy Campbell, vice-president and treasurer, joined the firm in 1922; Robert F. Porter, vice-president in charge of sales, served as president of the National Ready Mixed Concrete Association in 1949, and has been with the company since 1923.

Portland Cement Production

THE PORTLAND CEMENT INDUSTRY produced 17,433,000 bbl. of finished cement in January, 1951, as reported to the Bureau of Mines. This was an increase of 15 percent compared with the output in January, 1950. Mill shipments totaled 12,237,000 bbl., an increase of 27 percent over the January, 1950, figure, while stocks were 10 percent below the total for the same month in 1950. Clinker production during January, 1951, amounted to 19,132,000 bbl., an increase of 13 percent compared with the corresponding month of the previous year. The output of finished cement during January, 1951, came from 149 plants located in 35 states and Puerto Rico. During the same month of the previous year 15,202,000 bbl. were produced in 147 plants.

Coming Conventions

May 16-18, 1951—

National Industrial Sand Association, 16th Annual Meeting, The Homestead, Hot Springs, Va.

May 24-26, 1951—

National Lime Association, 49th Annual Convention, The Homestead, Hot Springs, Va.

June 13-14, 1951—

National Agricultural Limestone Association, Mid-Year Convention, Hotel Sheraton, Chicago, Ill.

Changes Firm Name

JESSE A. KUTZER, sand and gravel producer, has announced the change of his firm name to Kerrville Sand and Gravel Co. New offices for the company will be located on Junction Road, Kerrville, Texas.

Serialization Order (MO-7) Issued

THE DEFENSE MINERALS ADMINISTRATION, Department of the Interior, as a means of expediting its program of assistance to the mining industry, issued, on April 17, an order (MO-7) providing for the establishment of identification numbers or serial numbers for mines, smelters and mineral processing plants to be used in obtaining priorities and allocations of scarce materials.

Applications for serialization must be filed with D.M.A. on Form MF-100 not later than June 1, 1951, according to the order which also states that only those producers who have been granted serial numbers under this order will be eligible for such D.M.A. assistance in obtaining equipment, machinery and operating supplies. Copies of Form MF-100 are available at Washington, D. C., and at regional offices of D.M.A. No additional application form, it was stated, need be filed for this purpose; after serialization, if priority assistance is desired for capital equipment, application may be made by letter.

The order applies to producers in the United States, its territories and possessions, and included mines (other than petroleum, solid fuels and natural gas), nonferrous smelters and mineral processing plants. It also applies to such foreign producers who may seek assistance and whose applications will be transmitted to D.M.A. by the Economic Cooperation Administration or the Office of International Trade, or in the case of Canadian producers, through the Canadian division of the National Production Authority. The order is also designed to assist prospectors as operating properties.

Information in the applications for serialization will enable D.M.A. not only to provide priority and allocation assistance under its programs relating to the maintenance and acquisitions of facilities, machinery equipment, and operating supplies by the mining industry, but the same form will also provide D.M.A. with data needed when the mineral industries file applications for other types of government assistance.

D.M.A. is the claimant agency for the mineral industries and its job is to help assure the necessary production materials for maintenance, repair, and operation of metal mines, nonmetallic mineral mines, and nonferrous smelters, which means an adequate supply of repair parts and new equipment.

Homes for Employes

CALAVERAS CEMENT CO., San Francisco, Calif., has purchased a 15-acre tract adjoining a subdivision near its San Andreas plant. The tract will be subdivided into 40 lots for the purpose of constructing homes for employes. Financing will be arranged by the company, with first preference among purchasers to be employes of the company.

Mica Sources

IN RECENT YEARS, Brazil has been the largest single supplier of mica to the U. S. market. Other sources are Canada, India, Argentina and Madagascar. The Bureau of Mines and the Geological Survey have stated that there are no measured reserves of mica within the U. S., but during World War II, the domestic industry was able to provide 10 to 15 percent of consumer demands, and it is believed that in case of another emergency, explorations might disclose other domestic sources. However, production costs within the U. S. would probably exceed those of other regions possessing extensive concentrated deposits. For example, in 1944, consumption of mica totaled 3,728,888 lb., of which domestic sources supplied only 726,500 lb. Although the market price was only $1.50, the government paid domestic producers $6 a lb., in addition to handling and marketing charges. Both private and government-sponsored research has succeeded in developing ceramic and plastic substitutes, but mica still remains a strategic and critical mineral.

Secondary Boycott Cases

NATIONAL SAND AND GRAVEL ASSOCIATION sent to member companies a letter pertaining to the National Labor Relations Board jurisdictional standards in secondary boycott cases. The association feels there is danger that the N.L.R.B., through its administration policy with respect to the jurisdiction which it will agree to assume, may take away from the sand and gravel industry and others similarly situated, much of the protection against secondary boycotts which congress intended to confer in the Taft-Hartley Act.

N.S.G.A. cited a recent case on which the N.L.R.B. had acted. In this case, the board decided that it would consider, in applying standards in secondary boycott cases, not only the business of the company with which the union had its direct dispute, but also the business of the concern on which the secondary pressure was being put. The dispute in this particular case was between the truck drivers union and Pearl City Fuel Corp. over the fact that the Pearl City drivers were non-union, which resulted in picketing at the site of construction jobs by two companies for each of which Pearl City was supplying ready-mixed concrete. The board held that in determining whether the jurisdictional standards were met it would add together the business of Pearl City and the two construction companies to the extent that the latter were effected by the conduct involved. It happened that even when they were all added together, the jurisdictional standards were not met, and the case was dismissed. The board stated its position as follows:

"Accordingly, in determining whether the board will assert jurisdiction in which secondary boycotts are alleged, we must consider not only the operations of the primary employer, but also the operations of any secondary employers, to the extent that the latter are affected by the conduct involved. Of course, if the operations of the primary employer alone meet the minimum requirements under the board's current policy, jurisdiction should be asserted without further inquiry. Where, however, the operations of the primary employer do not satisfy the board's jurisdiction standards, we must, in addition, consider the operations of the secondary employers, but only insofar as such operations are affected by the alleged unlawful boycott. If, taken together, the business of the primary employer and that portion of the secondary employers' business which is affected by the alleged boycott meet the minimum standards, jurisdiction ought to be asserted."

Plaster Studies

THE UNITED STATES Department of Commerce and the National Bureau of Standards recently published a report on "Investigations of Failures of White-Coat Plaster." The chief cause of these plaster failures, and which was the basis for the study, has been a recurrent type that appears as a bulge, or blister, in the white coat of plaster which may or may not affect the underlying coat. This report presents the results of tests made on material taken from a large number of plaster failures of the blister type, scattered over the eastern United States. Detailed discussion is given of the preparation and properties of white-coat plaster and of the investigation leading to the conclusion that delayed hydration is responsible for the blister type of failure. Methods for the preparation of white-coat plaster, by autoclave hydration, have been developed as a result of the study.

Among the subjects discussed in the report are plaster and plastering; description of failures; formation and subsequent history of white-coat plaster; investigation of white-coat-plaster samples taken after failure; investigation of base coats; possible causes of failure other than hydration of magnesia; preventing failure; and methods of repairing damaged plaster.

Gravel Company Builds New Plant

ZANESVILLE GRAVEL CO., Zanesville, Ohio, recently began operations at its new plant location, on a 40-acre tract, four miles south of Dresden, Ohio. Construction of an all-steel structure with concrete footings, and installation of new conveyors, bins, screens and crushers was completed about May 1. The gravel company, formerly operating at a site two miles south of Dresden, had practically exhausted the gravel supply there.

The new plant and office cover an area of three acres. Digging operations are expected to reach a depth of from 40 to 50 ft. and the plant is expected to process 100 tons of gravel and approximately 800 tons of sand per hour. John J. Gorman is president of the company and his son, John Gorman, Jr., is secretary-treasurer. Ed Wine is superintendent and Carl Keyes is chief engineer. The company has been in business for 30 years.

State Association Meetings

MARCH SEEMS TO BE the month for the annual meetings of state associations. Iowa Agricultural Limestone Association held its meeting in Des Moines, March 7-8, and the Indiana Mineral Aggregates Association held its meeting in Indianapolis, March 15-16. A large number of Ohio fertilizer and limestone producers attended the Ohio Fertilizer and Lime Conference on March 16, in Columbus. The Agricultural Limestone Division of the Pennsylvania Stone Producers Association held its annual meeting March 22 in Harrisburg. The Missouri Limestone Producers Association held its annual meeting March 28-29, in Jefferson City, and the Kentucky Crushed Stone Association met March 31, in Louisville.

Attendance at these state meetings offered a good opportunity for the discussion of many matters of mutual interest, such as the appropriation for the Agricultural Conservation Program and in percentage depletion. With respect to the A.C.P. appropriation, the most disturbing thing to the associations seemed to be the position taken by the American Farm Bureau Federation in advocating a cut in the authorization for 1952 from $285,000,000 to $150,000,000.

Pavement Yardage

AWARDS OF CONCRETE PAVEMENT for the month of February and for the first two months of 1951 have been announced by the Portland Cement Association as follows:

	Square Yards Awarded During February 1951	During First Two Months 1951
Roads	2,399,664	5,598,506
Streets and alleys	1,214,092	3,465,754
Airports	1,221,842	1,421,753
Totals	4,835,598	10,486,013

HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Dislodging Crusher Hang-Ups

AT ALL PRIMARY crusher operations, a few common tools are needed, such as hooks to help remove or dislodge jammed stone. Among the many types of hooks used, steel wedges are the most common. The wedge is lowered behind a large stone in such a manner as to give the most possible leverage.

Steel wedge with wire rope sling

At one operation, a wedge was used that had a chain sling as part of the assembly. Under stress the chain broke and the entire works quickly passed into the secondary crusher, resulting in a plant tie-up for two hours while the welder cut the wedge out of the reduction crusher. At another plant, a wire rope sling is used to keep the wedge in bounds. Such a sling is far less apt to part under stress.

Stone Ladders for Transfer Between Belts

AT A SAND AND GRAVEL OPERATION which utilizes four to six miles of belt conveyors to deliver pit-run material to the processing plant, the practice is to deliver the pit-run material to a preliminary washing plant which is near the pit. Here the material is put through two 78-in. Wemco spirals and excess fine sand and clay is for the most part removed and sent back to a worked out portion of the pit. The material to be processed drops onto a segment of the field belt conveyor system and is carried to the plant over a series of belt conveyor flights.

As this material contains coarse to fine material, its transfer from belt to belt is done by using stone ladders of the type shown here, to minimize separation.

The operator of this plant is a pioneer in field belt transportation. Note the small chute at right to return belt spillage to the off-bearing belt.

Use for Worn Belting

THE SALVAGE VALUE of a belt conveyor has been estimated to be about 50 to 60 percent. At an operation that uses several miles of field-to-plant belt conveyors a number of uses for replaced belting have been devised. For example, when belts have served their usefulness as belt conveyors, they are used as a fence to enclose worked-out sections of the pit and to keep unwanted visitors away from the field belts.

Worn-out conveyor belts used to enclose worked-out pits

Truck Hopper

THERE ARE MANY TYPES of truck hoppers in use for unloading trucks over a primary unit of the plant. Many of these consist of two large I-beams with a channel provided on each to receive the truck tires and to help the driver guide the truck over the unloading bin. When this type is used, hand labor is usually necessary to keep the assembly clean as spillage from the truck soon fills up the grooves.

Heavy I-beams have flat plate tops so that spillage can be pushed into hopper by tractor and blade

One western operator uses the heavy I-beams with a flat plate top as shown in the illustration. Spillage can then be pushed into the hopper by a tractor and blade. At this particular operation, the passage-way is cleaned once per shift, and it is unnecessary to keep a man stationed at the unloading point.

To minimize separation, material is transferred from belt to belt by use of stone ladders

Novel Stockpiling Idea

AT A LARGE CONSTRUCTION JOB in the high Sierra Nevada Mountains, part of the aggregate is processed in a Universal portable plant. The primary section of the plant is mounted on the edge of a steep hill so that the material as it is screened on a Simplicity screen is spouted direct to its stockpile by a steel chute, as shown in the illustration. The chute conveys the material several hundred feet.

Two sizes of aggregate are spouted to storage piles at base of hill. Portable is in background and vibrating screen in foreground

Proper Bag Storage

DUE TO THE KOREAN EMERGENCY and our resultant industrial mobilization program, conservation of packaging materials by industrial users is important. An eastern paper and bag manufacturer believes that good storage practices are of prime importance for eliminating bag losses and he offers the following suggestions for proper bag storage:

1. Never store bags near any heating units nor in spaces near boiler or furnace rooms.

2. Paper shipping sacks should be stored in cool, well-ventilated rooms, away from the floor (on pallets), and the floor should be kept wet so moisture can be absorbed in the air.

3. The storage room should be kept at a temperature of about 70 deg. F., with a 50-60 percent relative humidity; the paper will then retain about 6½ percent moisture and will be flexible and strong.

4. If a commercial humidifier is not available, a makeshift humidifier may be installed. For this, several large-size barrels or pails filled with water should be spaced at even intervals throughout the room. From these containers pieces of burlap or toweling are suspended in the form of a wick, with one end of the wick remaining in the water.

5. Dried-out paper bags can be brought back to their original flexibility and strength by opening up the bales and spreading out the sacks in a humidified room, or on a covered loading platform in rainy weather, for 24 to 48 hours.

Chains Facilitate Crushing Operation

AT A DAM now under construction on the North Santiam river in Oregon, crushed rock is used as the aggregate and one of the largest deep-frame jaw crushers in the world is used as a primary crusher at this operation.

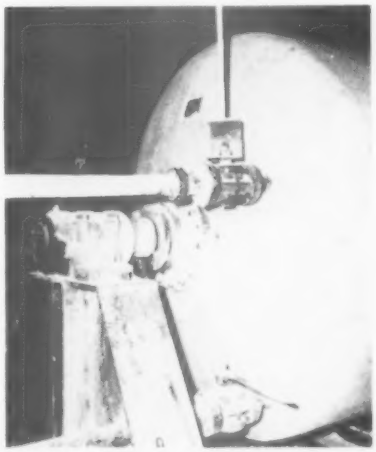
Trucks haul the quarried diorite downgrade to the primary crusher where it is rear-dumped into the receiving hopper over the throat of the crusher.

To help control the flow of rock to the crusher, ten strands of heavy chain, as shown in the illustration, are suspended from two I-beams.

Heavy chains control flow of rock to crusher

High-Pressure Hydration

THE FIRST LIME PLANT to use the high-pressure hydrating system on lime burned in a rotary kiln, as developed by a Pennsylvania lime producer, has been in operation in the west for some time. (The high-pressure hydrating process used prior to this installation was on lime burned in shaft kilns only.)



Discharge from pressure hydrator is controlled by lubricated plug valves

Under this process, finely ground lime is admitted to a hydration vessel where, under suitable pressure, the hydration is completed. Valve lines to and from the pressure cylinder have to withstand severe conditions such as high temperatures, climatic conditions that produce rapid rusting, etc. At this installation, Nordstrom lubricated plug-valves are used. The valves shown in the illustration are on the discharge end of the hydrator and are remote controlled. This type of valve is simple and can be opened and closed under severe conditions. A hard lubrication is used which tends to eliminate the problem of sticking valves.

New Machinery

ROCK PRODUCTS

Rotating Disc Valves

LEDEEN MANUFACTURING CO., Los Angeles, Calif., has in production a line of valves for actuating air or hydraulic cylinders, which embody rotating disc construction and are made

Valves for actuating air or hydraulic cylinders

in three types: for hand-operation, foot-operation and finger or solenoid operation. This group of valves is available in 14 different models for five different cycles in six sizes and may be used for controlling the flow of air, oil or water.

Dual Drive

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis., is applying the "Duo-Tork" drive, a staggered pinion dual drive, to all of its rotary kilns with power requirements of 150 hp. and over. The new drive incorporates the 20-deg. involute short addendum gear and long addendum pinion. The manufacturer claims that the tooth pressure is half that of a single pinion drive incorporating the same gear and horsepower, which permits a narrower and smaller pitch gear with a reasonable ratio of face to pitch. It is also said that the staggered pinion drives provide twice as many tooth contacts per kiln revolution as with a single pinion drive.

Metallic Coated Electrode

RANKIN MANUFACTURING CO., Los Angeles, Calif., has developed a new metallic coated electrode for arc welding. The core wire is of high alloy cast material and it is said that the special coating further increases the alloy content of the weld. Ranite No. 4 Electric, as the 18-in. rod is called, can be gripped anywhere along its length. At 800 deg. F. the Rockwell C hardness is 45, the ultimate hardness ranging from 56 to 60 on the same scale. Among the uses for which the electrode is said to be applicable are in the maintenance of mill hammers, screw conveyors, mixing blades and cement mill grinding rings.

Welding Process

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, has announced a welding process which employs welding current densities on 5/64-in. electrode wire which, according to the manufacturer, melt the electrode at speeds comparable to using 10,000 amp. on a standard 5/16-in. dia. coated hand electrode. Welding currents up to 600 amp. are used with either a 3/32-in. or a 5/64-in. dia. electrode wire which, on the small cross-sectional area of the wire, produce high current den-

Hidden arc welding process

sities that create a deeply penetrating arc which, in turn, allows the use of high welding speeds.

Wagon Drill

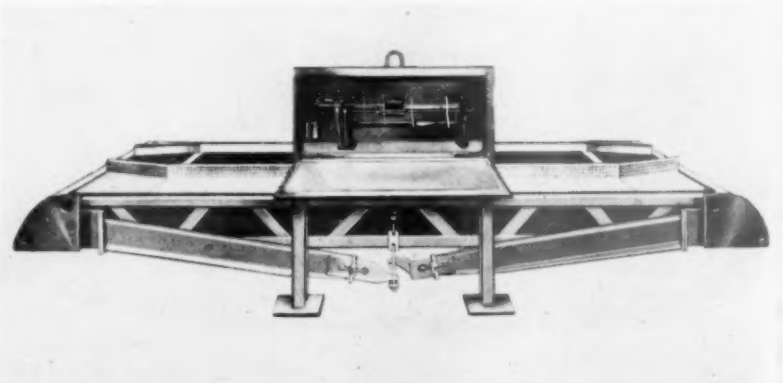
INGERSOLL-RAND CO., Phillipsburg, N. J., has developed a wagon drill which is said to permit unlimited drill-

Wagon-mounted drill

ing positions of the tower or drill guide. Features claimed by the manufacturer are: a slide-mounted tower for additional flexibility, a one-piece tubular steel frame for lightness and rigidity, and a 2-qt. capacity lubricator to provide ample lubrication.

Truck Scale

THURMAN MACHINE CO., Columbus, Ohio, has announced production of a truck scale, which can be moved from one location to the next by removing six nuts that hold the side arms in place. Standard capacities are 18, 20 and 30 tons with deck lengths from 18 to 30 ft.



Portable truck scale

Hydraulic Tractor Loader

TRACTOMOTIVE CORP., Deerfield, Ill., is manufacturing a tractor loader featuring a hydraulic torque converter drive and a new design clutch-type transmission said to eliminate most gear shifting. The unit is mounted on rubber tires, has a ¾-cu. yd. hydraulically controlled bucket and weighs 10,650 lb. Power is furnished by an Allis-Chalmers 40.5-brake hp. gasoline engine.

Tractor loader with clutch-type transmission

pH Meter

ANALYTICAL MEASUREMENTS INC., Chatham, N. J., is manufacturing a pocket-size pH meter and companion probe unit. Self-contained with batteries, in a case 3 x 5⅞ x 2½ in.,

Pocket-size pH meter

this instrument is furnished with plastic tubes of buffer and KCl solutions. Supports and beakers are eliminated by combining the calomel and glass electrodes with the sample holder, in a single polyethylene probe unit.

Heliocentric Reducer

UNIVERSAL GEAR CORP., Indianapolis, Ind., has designed a Heliocentric speed reducer, said to save cost and conserve space in all in-line reducer applications in the ¼- to 1-hp. range. The manufacturer claims that this unit, Model 5-E, is suitable for any straight-line installation in which the input r.p.m. does not exceed 1800. Maximum torque capacity is 1000 in.-lb.

Valve to Clean Air Lines

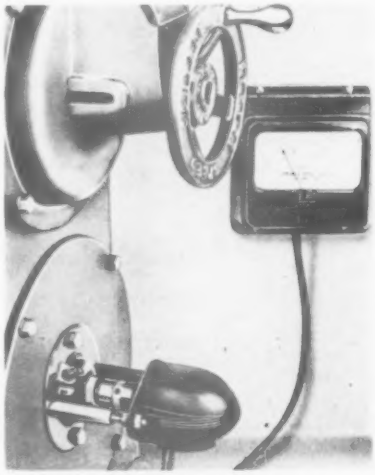
WILKERSON CORP., Denver, Colo., has announced a newly engineered line of valves for automatic removal of contaminants and precipitates from compressed air lines, sumps, tanks and air brake systems. As air is used the pressure differential raises the diaphragm and shaft, seals the bottom of the middle chamber, opens the bottom of the sump and blasts out contamination. The line includes automatic separators and drains.

Telephone Answering Unit

ELECTRONIC SECRETARY DISTRIBUTORS, INC., Milwaukee, Wis., has announced its telephone answering machine, which is said to answer the phone automatically, take messages and tell the caller when the party will return. The manufacturer states that the unit is easily installed since it is not attached to the phone, but merely plugged into a socket.

Tachometer

REEVES PULLEY CO., Columbus, Ind., has added an electric tachometer to its line, as a replacement for its mechanical unit. It is claimed that the new instrument has been designed especially for quick and easy installation on the company's variable speed drives, in capacities from ¼ to 87 hp. The manufacturer states that this tachometer, which operates on the a-c generator principle, allows more flexibility of installation, since the indicator may be mounted as far as 300 ft. from the speed drive.



Details of electrical tachometer

Scoop Machine

MIXERMOBILE MANUFACTURERS, Portland, Ore., has in production its Super-Scoopmobile, claimed to be the largest materials handling scoop of its kind. The whole machine weighs over 18 tons and the scoop bucket has a level capacity of 5 cu. yd. The heavy-duty four speed forward and reverse transmission is powered by a 4:1 planetary drive axle from a 250-hp. diesel engine.

Scoop machine with 5-cu. yd. capacity bucket

Inland Lime and Stone Co.'s plant; behind switch engines in center is the grizzly house and at left are traveling stacker conveyors building stockpiles

TWENTY THOUSAND TONS OF STONE DAILY!

Inland Lime and Stone Co. plant at Manistique, Mich., has been adapted over the years to produce increasing tonnages of commercial crushed stone simultaneous with fluxstone operations

A MAJOR SHARE of the cost of fluxstone delivered at blast furnaces and open hearth furnaces results from transportation charges. Therefore, availability of inexpensive lake shipping was the deciding factor in developing the crushed stone plant of Inland Lime & Stone Co. in Michigan's Upper Peninsula. The quarry, located on a large deposit of high calcium limestone near Manistique, is connected to the crushing plant at Port Inland, seven miles away, by an electric railroad.

Although the quarry and plant were placed in operation primarily as a source of fluxstone for the parent company, Inland Steel Co., sale of the commercial sizes of stone produced as a by-product is necessary for economical plant operation. These factors were kept in mind in designing the plant, finished stone storage and dock facilities at Port Inland. Another factor having a bearing on design of these units is that the lake shipping season extends only from April through November, and all stone must be processed and shipped in this eight-month period.

Preliminary engineering work for the quarry and plant was begun in 1928, and production during the first full year of operation, 1931, amounted to 1,000,000 tons. In 1950, the company produced and shipped approximately 4,000,000 tons of high-calcium limestone ranging in size from 12-in. fluxstone down to specification stone sand.

It is interesting to note that the 400 percent increase in production between 1931 and 1950 was achieved with almost no additions to equipment in the mill proper. In 1928, when the plant was orginally designed, capacity was figured at 2,000,000 tons with operations on a five-day week. According to C. B. Randall, president of Inland Steel Co., "It has been most gratifying to those of use who were active in the early stages of planning of the operation to find that the mill can process twice the original planned tonnage without major additions of equipment or changes in plant flow."

But major changes that were necessary in order to increase finished stone production were made at the quarry, where a third shovel was added to load quarry-run material to additional haulage equipment. Also trackage was added to the route between quarry and plant to provide additional turn-out zones so that the number of trains could be increased. The third change made necessary by increased tonnages through the plant was in the dock area provided for storage of finished stone prior to its being loaded to lake boats.

As plans for the operation took form, it became increasingly evident that because of the short work period imposed by the northern climate, coupled with the fact that lake boats carrying 10 to 20,000 tons per trip would be loaded at the dock, the plant would perforce be one of large capacity. Therefore the original plans included a standard gauge railroad for quarry to plant haulage. Use of a standard gauge rail car for haulage dictated that at least a 60-in. gyratory crusher

be installed in the plant for primary crushing. With these two items fixed, two 5-cu. yd. shovels were placed in the quarry.

Management of the company realized from the first that Inland Steel Co. alone could not absorb all fluxstone produced, and so part of the plant's capacity is sold to other steel producers.

Given a physical plant of the magnitude of Inland Lime & Stone Co., the only means of increasing or decreasing production is through control of the hours worked. When the plant first started operation, the primary crusher worked an approximate average of 10 min. per hr., whereas in 1950, with two additional quarry trains, an additional quarry shovel, plus a 3-shift, 7-day week, crusher operation averaged better than 40 min. per hr.

Officers of Inland Lime & Stone Co. are A. J. Cayia, president; P. D. Block, Jr., vice-president; W. Moon, treasurer, and Graydon Megan, secretary.

Operating personnel at the quarry and plant include A. W. Heitman, general superintendent; John Moffat, assistant superintendent; Sidney Bouwer, chief engineer; Wilbur Fairchild, chief chemist; Al Larigne, chief clerk; John Wilde, general quarry foreman; Amos Bowman, general mill foreman; Daniel Harrington, master mechanic, and Melvin Kimmel, chief electrician.

Aggregate Distribution

Users of Inland stone in the Great Lakes area, in addition to Inland Steel Co., are located from Duluth to Chicago, Detroit and Buffalo. In the early operation a market had not been developed to consume all the finer sizes of stone that naturally result from production of fluxstone. This resulted in a stockpile of stone sized from 1½-in. down. And, too, during war years with their huge demand for fluxstone, the smaller sizes again accumulated. Realizing the need for finding some market for this stone, the Inland Lime & Stone Co. vigorously attacked the problem and now maintains over 20 docks, served by lake boats, as distribution points for not only fluxstone, but aggregate and stone sand as well.

The picture today is a very different one with the demand for commercial sized stone frequently outstripping its normal production. The pile of small sized stone formerly deposited at one side of the plant is today being reclaimed with a dragline and returned to the plant for further processing as commercial stone whenever plant schedules permit.

As over 90 percent of production is shipped by water, months of plant operation are limited to the Great Lakes navigation season which is from April 1 to December 1, approximately. Winter months are used for maintenance, repair and expansion work at the plant and drilling blast holes for the next season's production at the quarry. Both quarry and plant are operated on a 3-shift, 24-hr. day with production averaging over 20,000 long tons per 24 hr. during the operating season.

A 7-mile electric railroad connects the quarry to the plant. At the present time there are six trains operating over this railroad, one arriving at the plant every 20 min. Each train consists of a locomotive, with a 40-ton load for added traction, pulling nine 30-cu. yd. side-dump cars.

Finished stone is stockpiled in the dock area over reclaiming tunnels for conveyor-belt transfer to a boat loading shuttle on the dock. This harbor was constructed solely for the operation of Inland Lime & Stone Co. and is known as Port Inland.

Land available at the quarry site amounts to roughly 10,000 acres. Workings at the quarry are approximately 6500 ft. long by 4400 ft. wide with a face that is approximately 35 ft. high. There is an additional 30 to 35 ft. of stone below the present floor which will be removed at a later date.

Stripping of overburden is primarily a winter operation, though some additional material must be removed during summer months. Overburden averages 6 ft., though it varies from a few inches to 12 ft. For winter stripping one of three 5-cu. yd. Model 170-B Bucyrus-Erie electric quarry shovels is brought up to the surface area and a railroad track constructed so that stripping of the thicker overburden may be loaded to rail cars for dumping at a point one mile distant. Overburden is wasted into a former lake and swamp area that was drained by the company for this purpose. For summer stripping operations a 2½-cu. yd. Bucyrus-Erie electric shovel loads waste material to dump trucks. This same shovel can be loaded on a flat car for transfer to the plant when its services are required in that area.

International bulldozers and a LeTourneau rubber-tired bulldozer powered by a Buda diesel engine handle some of the lighter stripping in summer months, pushing it into windrows for later loading to trucks by power shovel. These dozers and a Caterpillar diesel-powered motor patrol are used not only for light stripping operations, but also for maintenance work on quarry and stripping roads.

Drilling and Blasting

Present blast hole drilling is accomplished with five 27-T Bucyrus-Erie churn drills and one Joy Heavy Weight Champion rotary drill using a Hughes Tri-Cone roller bit. Operation of the latter drill has been experi-

Top: One of two live roll grizzlies with 6-in. openings operating in parallel in the grizzly house. Center: Manually-controlled choke gate over 48-in. belt in one of the reclaiming tunnels, which extend under dockside stockpiles. Bottom: Primary crusher house; 60-in. gyratory is in foreground, and grizzly bars with 6-in. spacing extend above it

mental in this rock formation; however, the results are considered encouraging. This drill employs compressed air for removing bit cuttings. Mr. Heitman points out that due to cold winter drilling operations, it would be impossible to use water for cleaning blast holes. Both types of equipment drill a 6-in. blast hole approximately 38 ft. in depth. These are charged with either Atlas or du Pont powder. One type or the other is used consistently for an entire blast. These blasts are fired with Rock Master delayed action blasting caps or Primacord.

Blasting is carried out in the winter months to a limited extent but most of the blasting is done during the operating season one cut at a time. One of the largest blasts on record at this quarry used more than 240 tons of dynamite and other explosives. This blast caused an earth tremor that was recorded on seismographic equipment in Washington, D. C.

Blasting pattern consists of two rows of staggered holes with 25-ft. burden and 20 ft. between the two rows. Spacing between holes is 18 ft.

Fragmentation at this quarry is quite complete with little stone left for secondary blasting. Secondary blast-hole drills are the usual pneumatic type. One of the engineers employed at the operation is primarily concerned with drilling and blasting and is charged with maintaining a high ratio between tons of stone brought down to pounds of powder employed. In the drafting room at the main plant office, profiles are kept of each blast with notes concerning fragmentation, amount of remaining toe and existing quarry floor. Coupled with these profiles are notes on deposit depths obtained from earlier exploratory test drillings.

Material Handling

Present loading of quarry-run stone is accomplished by the three 5-cu. yd. shovels, one working at each of the three quarry faces. The fourth end of the quarry provides the approach to the quarry floor level. There are three sets of tracks, one running to each quarry face. At the end of each track a switch and spur track, paralleling the quarry face, is located so that while one train is being loaded, the second train can pull onto the siding and be ready to back in under the shovel immediately after the first train is dispatched to the plant. Although the size of the operation and quarry-haulage equipment would allow the use of a larger bucket on the power shovels, these have been kept at 5 cu. yd. so that all stone passing the shovel dipper will readily enter the primary crusher. This eliminates plugging the crusher with its resultant delay. Electric locomotives at this operation were made by Differential Car Co. and operate on standard gauge 90-lb. steel rail. The quarry is at an elevation 150 ft. above the plant and a one percent grade limit has been maintained for the 7-mile run.

The transportation cycle calls for: one train dumping to the primary crusher; one train returning to the quarry; one train moving to the mill; and three trains loading at the quarry. It takes approximately 20 min. to dump the nine 48-ton cars and locomotive stoneload at the crusher. The run from the quarry to the plant or return is figured at 20 min. each and loading time at the quarry is computed at 60 min.

When a train arrives at the plant the cars are dumped in sequence, the first one behind the locomotive being the first to dump. The load in the body of the locomotive car is not dumped until all the 9-car train is emptied. When the last car has been dumped, the train backs up so that the engine car can be dumped, its load being retained until this time for added traction as a precautionary measure. By the time one train has finished dumping its load, a second train is usually arriving at the primary crusher so that there is no waiting time at the plant.

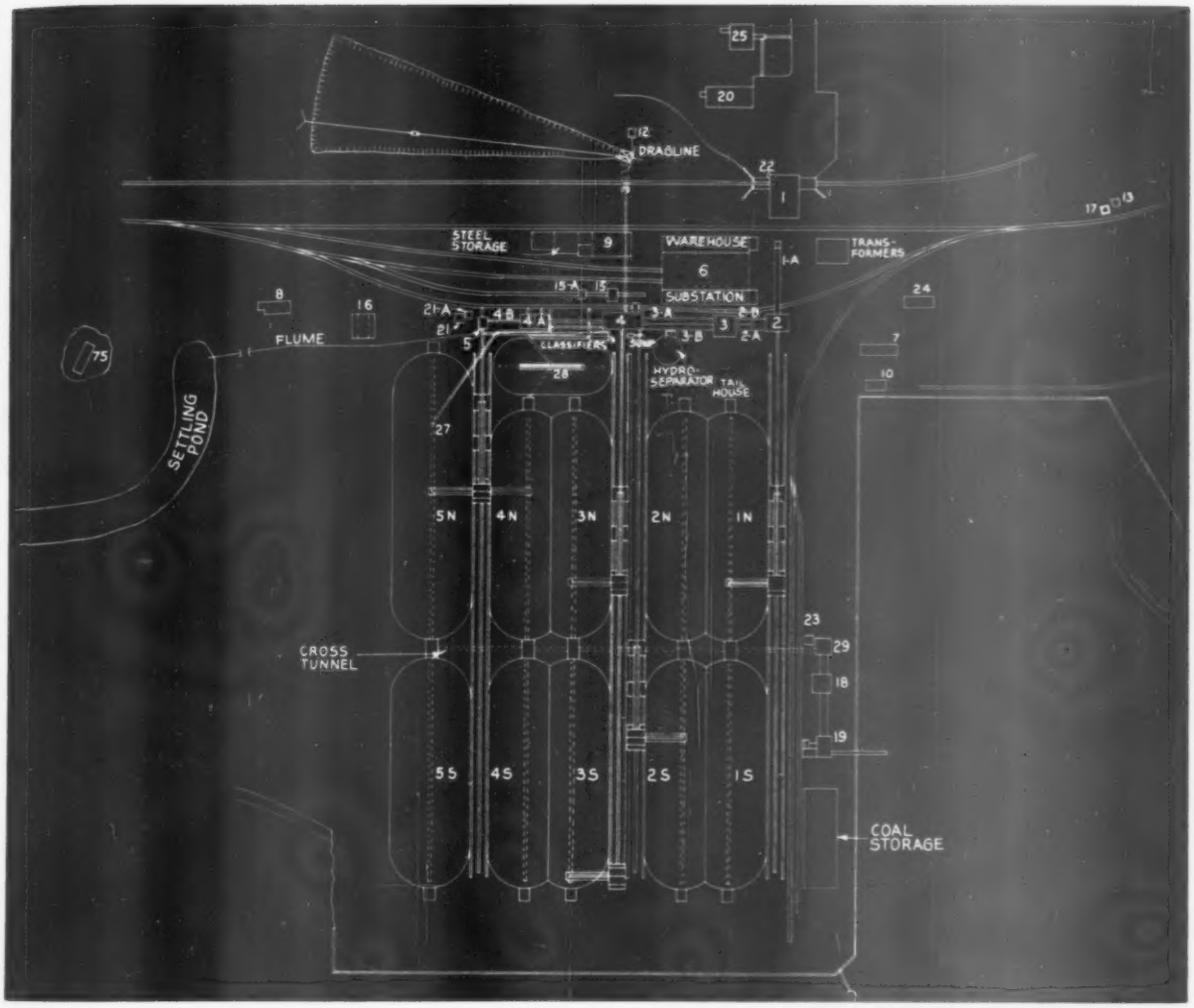
Located in the primary crusher house through which the quarry trains pass, and at a point opposite the crusher, is a compressed-air cylinder car dumper which tilts the bodies of the all-steel rail cars for dumping. The side of the car adjacent to a grizzly ahead of the crusher is hinged and automatically lowers to dump the load as the body is tilted. It returns to normal position as the car body is lowered to the rail carriage. Cars dump to a stationary 6-in. bar grizzly. It is inclined at a steep angle. Its primary purpose is to allow excessive fines from the load to form a cushion on the primary crusher discharge belt. The primary crusher at this installation is a 60-in. Superior McCully gyratory that is set for 6¼- to 8-in. discharge.

A 48-in. Amsco pan feeder operates under the hopper, receiving both grizzly throughs and crusher discharge. This feeder serves conveyor A-3, which is a 48-in. belt on 220 ft. centers, operating at 450 f.p.m. and carries the material to the grizzly house. Discharge from this belt falls to a live-roll grizzly with 12-in. openings. Oversize from this grizzly, plus 12-in. stone, is chuted to either a hopper car as paper mill stone or is returned to the plant for recrushing. Throughs, minus 12-in. material, are evenly divided by a pants-leg chute for diversion over two 6-in. live-roll grizzlies operating in parallel. Oversize from these two grizzlies passes through a proportional flop-gate that can divert all or any part of the flow to the No. 1 stacker belt operating on the dock. This is the largest size of fluxstone produced as a finished material and is used in open hearth furnace operation.

Alternate flow for this plus 6-in. material through the flop-gate is to conveyor B-1 for transfer to the secondary crusher house. This conveyor is a 42-in. belt operating on 150-ft. centers to take oversize from the two live-roll grizzlies to the secondary crusher, a No. 20 McCully gyratory

One of 5-cu. yd. electric quarry shovels loading electric train; there are six all-steel trains similar to the one shown

Conveyor belts operating in parallel transfer minus 6-in. material to screens; these are in the main screening plant



Numbers following identify equipment in the plant layout above: 1, primary crusher house; 1-A, A-3 gallery; 2, grizzly house; 2-A, B-1 gallery; 2-B, B-2 gallery; 3, secondary crusher house; 3-A, B-3 gallery; 3-B, B-8 gallery; 4, screen house; 4-A, fines bin and conveyor; 4-B, C-1-C conveyor; 5, 30-in. transfer house; 6, machine shop; 7, foreman's office; 8, carpenter and paint shop; 9, steel warehouse; 10, pump house; 12, dragline house; 12-A, waste reclaiming trestle; 13, sand drying house; 14, R. R. scale house; 15, pulverizer building; 15-A, pulverizer bin; 16, tractor storage shed; 17, R. R. water tank; 18, shuttle drive house; 19, shuttle house; 20, harbor garage; 21, brine tank boiler house; 21-A, brine tank; 22, gateman's house; 23, dock locker room; 24, laboratory; 25, main office building; 26-A, No. 1 stacker; 26-B, No. 2 stacker; 26-C, No. 3 stacker; 26-D, No. 4 stacker; 27, scalp stacker; 28, sand stacker; 29, 60-in. transfer house; 75, dolomite comp. house; 1N, 1S, 2N, etc., ten concrete tunnels

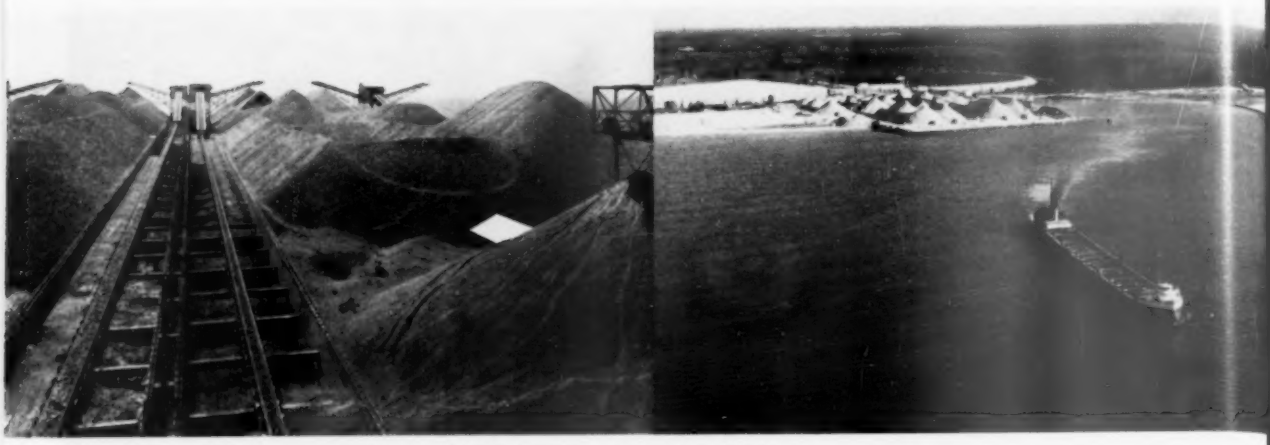
set for 4-in. discharge. Material passing this crusher falls to a live-roll grizzly with 6-in. openings. Any oversize remaining at the lower end of this grizzly is reduced by a slugger roll that rotates in a direction opposite the last roll of the grizzly, forming a type of roll crusher at this point.

Throughs from the first pair of 6-in. grizzlies fall to conveyor B-2, a 42-in. belt on 80-ft. centers. This minus 6-in. material is transferred to conveyor B-3, a 48-in. belt on 190-ft. centers which also receives minus 6-in. material from the third 6-in. grizzly (with slugger roll, handling secondary crusher discharge). This belt conveyor transfers material to the screen house. Conveyors B-2 and B-3 operate at 450 f.p.m. Conveyor B-3 discharges via a proportional flop-gate onto two 7- x 11-ft. vibrating double-deck screens. These screens carry 4-in. mesh on the top deck; mesh on the bottom deck varies from 1½ to 2¼ in., depending upon desired end product. Since the plant is located on the shore of Lake Michigan, wash water is no problem. Total pump capacity for water used in screening is 3000 g.p.m.

Throughs from the bottom deck of these screens fall to two additional screens operating in parallel. The second pair of screens are 7- x 11-ft. three-deck vibrating models. Mesh sizes on these screens again vary depending upon desired end product with the top deck range from ⅜ to 1⅛ in. and middle deck range from ⅛ to ¾ in. The bottom deck mesh is always kept at ⅛ in. All screens and belt-conveyor frames at this plant are Stephens-Adamson.

Material passing the top deck, as well as material passing the second deck of these final three-deck screens, is conveyed to individual 500-ton surge bins or to a stacker belt (No. 4) on the dock as finished material. As one

Blast-hole drill utilizes compressed air to blow out drillings



Left, above: Stockpile arrangement over reclaiming tunnels on dock at Port Inland. In the center and at the left are one-arm stackers; a two-arm stacker is at right. Belt conveyors transferring stone from plant to stackers are on 900 ft. centers. Right, above: Loaded lake boat leaving dock

stacker belt handles both these sizes of commercial stone, one at a time, the two surge bins were included at this point in the flow so that one size can be directed to a bin while the other size is being stockpiled. The two hoppers or surge bins feed directly to the stacker belt. Gates under the two surge bins as well as those gates in tunnels under stockpiles of finished stone are of the choke type—a chute under the gate is raised by a chain from a hand-operated winch to choke off flow of material.

Throughs from the bottom deck of the two final screens operating in parallel, minus ¼-in. material, are conveyed to a Dorr 40-ft. dia. hydroseparator with a 9-ft. deep bowl. A 5-hp. totally enclosed motor drives the revolving rake. Underflow from the hydroseparator is transferred by a Wilfley pump to two rake-type Stephens-Adamson sand classifiers. Overflow from the hydroseparator is sent to a settling pond via open troughs. At the end of the season when plant operation is stopped, this material is reclaimed by a clamshell and stockpiled for draining at one edge of the pond. These fines, upon drying, are marketed as agricultural limestone. Underflow from the sand classifier is transferred to manufactured-sand storage via a 30-in. stacker belt or it can be loaded directly to rail cars. Overflow is flumed to the settling pond.

Manufactured Sand

Production of manufactured sand at this operation was not called for in the original plans, but the production of fluxstone and smaller sizes of commercial aggregate produced so many fines that their presence as waste presented a real problem. Wash water carrying these fines could not be returned to the lake because of the excessive pollution that would result. At first, the only means of removing these

Boat being loaded with stone at Port Inland dock. A 12,000 ton lake carrier can be loaded from this one conveyor in five hours

fines was by the installation of a huge settling pond at one side of the plant. But even with the settling pond, the collected fine material posed a major problem as it was unclassified and therefore an unmarketable material.

At this point, the hydroseparator and sand classifier were introduced to make the former waste product marketable and to make the transporting of it from the plant a profitable undertaking. Sieve analysis of this stone sand is:

Passing sieve	Percent passing
⅜	100.0
No. 4	99.3
No. 8	91.4
No. 10	82.4
No. 16	55.4
No. 30	29.8
No. 40	20.7
No. 50	13.5
No. 60	10.4
No. 100	4.1
No. 200	1.0
F.M.	3.07

Oversize on the top and bottom decks of the first pair of screens can be returned to a third crusher by conveyor B-8, a 30-in. belt operating on 75-ft. centers. This final crusher is a 4-ft. Symons cone which discharges to conveyor B-3 for reelevation to the screen house in a closed circuit. All stone sizes other than those previously mentioned that are separated by the screens are transferred to the dock storage area by stacker belts as finished material.

Recovery of material for reprocessing from the dump that was built up near the plant in the early years and during the war is accomplished by a

Gasoline-powered 25-ton crane with 50-ft. boom used for laying track in quarry

Sa erman dragline with a 2-cu. yd. bu ket. This bucket dumps to a 10-cu yd. hopper which feeds a 24-in. co veyor belt on 220-ft. centers for delivery to the screen house. At a point roughly 100 ft. from the hopper a tripper on this belt conveyor can divert this partially sized stone to one or more of three hammermills to produce pulverized material which is loaded directly to railroad cars. These hammermills are a Williams and two Gilsons.

Stockpiling

Stockpiles in the dock area contain every size of stone produced at the mill from 12-in. fluxstone down to manufactured sand. These piles are built by four stackers, three with a single stacker arm and one with two arms that can build a pile on either side. These stackers operate in self-powered superstructures mounted on rails and build stockpiles 900 ft. in length. There is also a stockpiling unit which rehandles material placed by one of the single stackers. On the dock there are five rows containing ten separate piles of individually sized stone that are kept separate by concrete division walls. There is also a stacker belt devoted to sand storage.

These ten stockpiles, each 50 ft. high and 400 ft. long, contain about 15,000 tons of live storage each for a total storage capacity of 160,000 tons of all sizes, including sand. Conveyor belts from the plant to stackers No. 1, 2, 3, and 4 operate on 900-ft. centers. Conveyors No. 1 and 2 are 42-in. belts; No. 3 is a 36-in. belt; and No. 4 is a 30-in. belt. These operate at a belt speed of 300 f.p.m.

Five reclaiming tunnels operate the length of the dock under the five main piles of sized stone. A small reclaiming tunnel and short belt connects the sand storage pile to one of these five major belts. Reclaiming tunnels are approximately 10 ft. wide by 12 ft. high and built of poured-in-place reinforced concrete. Each of these five tunnels contains two belts, one operating from either end to the center, and discharging to a common belt operating at right angles for delivery of material to dock side. The ten conveyor belts in the five tunnels are all 48 in. wide and operate on 400-ft. centers. These belts operate at 450 f.p.m. and are powered by 75-hp. totally enclosed fan-cooled motors. Capacity of these belts is 1500 t.p.h.

Cross belt in this stockpile area which operates in a tunnel at right angles to the ten conveyor belts previously mentioned is 60-in. wide and operates at 500 f.p.m. This belt, with a capacity of 3000 t.p.h., discharges to a 60-in. belt inclined at 17 deg. and operating on 175-ft. centers for discharge to the boat-loading shuttle conveyor. The boat-loading shuttle conveyor extends out over the water for loading of stone to boat holds. When a boat is loading at this dock it is warped forward or aft by a deck winch so that compartments of the hold may be filled evenly.

Load Weighing

An important phase of weight control at this loading operation consists of two Merrick Weightometers. One of these is located on the incline belt discharging to the boat loader and the second is used to weigh the screenings removed from the stone being loaded. A stationary, single-deck screen is located at the transfer point from the incline belt to the shuttle belt that removes excess fines from the stone before it is loaded for outgoing shipment. This screen is employed when commercial stone is being loaded and at the same point a live-roll grizzly is employed when loading metallurgical stone. In an operation as large as this, a scalping screen at this point is important as the down-grading of material falling to huge stockpiles or being transferred from belt to belt in this fast moving, high-capacity reclaiming system, produces some degradation and its removal improves the product. Loading time for a 10 to 12,000-ton boat is figured at approximately 5 hr. with this high-capacity belt system.

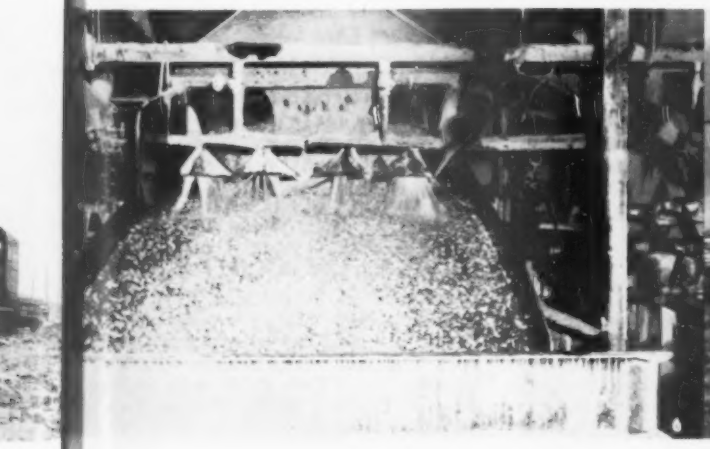
Shipments from Port Inland go out in both bulk lake boats and those of the self-unloading type. Inland Lime & Stone Co. controls one self-unloader for delivery of commercial stone. This boat uses a conveyor system to clean holds and transfer stone to bucket elevators that discharge to a conveyor boom that extends over the side of the boat for unloading. The older type of self-unloading lake boat uses a form of dragline bucket to convey material in the holds to bucket elevators for elevation to deck level.

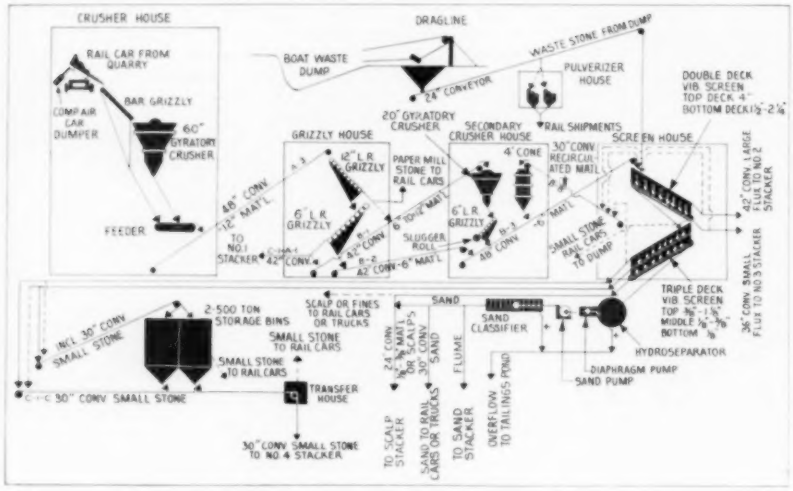
Shipments from this port, by weight, average approximately 70 percent fluxstone, 27 percent commercial stone, and 3 percent sand. Commercial stone here includes not only concrete aggregate but also chemical stone for cement mills, lime burning operations and agricultural limestone. As Port Inland is located at the north end of Lake Michigan with very little natural protection, a breakwater had to be built into the lake to afford protection for lake boats loading at the dock. These jetties were built from stone quarried in the company's dolomite quarry 1½ miles west of the plant. The main breakwater contains about 220,000 tons of rock. A 10-in. suction dredge is used through the summer months to maintain depth of the harbor, which is sufficient to accommodate the largest lake boats. An Allan-Sherman-Hoff Hydroseal dredge pump powered by 300-hp. General Electric motor mounted on a steel hull is used for this operation.

Stone Characteristics

Limestone at the quarry was formed in the Paleozoic era and belongs to the Niagaran series of the Lower Silurian period. Analysis of this stone is be-

Left: One of the two triple-deck 7- x 11-ft. screens operating in parallel. Right: Air view of dock and stockpiles at Port Inland. The piles at right foreground consist of partially sized stone that is reprocessed as commercial stone. A train from the quarry can be seen unloading at the grizzly house in center





Material flow through the Inland plant

tween 97 and 98 percent $CaCO_3$.

Physical characteristics of the stone show an average specific gravity of 2.67, an absorption value of .94 and a weight of 166.7 lb./cu. ft. One hundred revolutions of the Los Angeles rattler test give a rating of 5.38, and 500 revolutions yield 26.20.

The main office for the entire operation is at the main plant installation. This building houses the office of Mr. Heitman, the purchasing, accounting, engineering offices, and drafting room. A second very important building houses the shop facilities for complete maintenance of all equipment. Due to the isolated location, far from commercial shops, the shop is fully equipped to care for all emergencies. In this building screen tests are also conducted on each shipment of stone or sand from the plant. Smaller buildings on the property include carpenter and paint shop, steel warehouse, railroad scale house and the plant foreman's office.

Since the company trackage from quarry to plant is standard gauge, regular flat cars and other equipment can operate over it to transport dozers or shovels between quarry and plant. Two 60-ton two-unit diesel-powered switch engines are used at the plant. Although the greatest percentage of stone from this operation is shipped by lake boat, a small amount is shipped by rail.

Dock Facilities

Inland Lime & Stone Co.'s dock facilities at Milwaukee, Wis., are typical of the score or more such docks on all the Great Lakes. C. H. Weymier is manager of the Milwaukee installation.

Stockpiles of finished material at the Milwaukee dock contain 25 to 30,000 tons of crushed stone and manufactured sand when they are filled to capacity. These piles are built from the 235-ft. belt conveyor frame that is extended from the self-unloading boat and which may be raised or lowered in order to build these piles without rehandling of the aggregate. These boats take 5½ hours to discharge a cargo of 10,000 tons. Handled at the Milwaukee dock is crushed limestone for aggregate, high-calcium fluxstone, and manufactured sand for blacktop binder, seal coat and surfacing.

A Blaw-Knox 1-cu. yd. clamshell on ¾-cu. yd. Bucyrus-Erie gasoline-powered crane rehandles this stone, either loading trucks directly or charging either of two 65-ton capacity Butler truck hoppers. A self-powered Barber-Greene gasoline-powered bucket loader is also available for loading trucks directly from the stockpiles. A 20-ton platform-type Butler truck scale is located at the dock office.

Similar distribution points served by boat from Port Inland are located at Marquette and Munising, on the Michigan northern peninsula. In southern Michigan such docks are located at St. Joseph, South Haven, Muskegon, Ludington, Manistee, Bay City, Port Huron, and Detroit. In Wisconsin a dock is located at Green Bay, and in Illinois a dock is located at Chicago. Indiana Harbor, south of Chicago, is a terminal point for the fluxstone shipped to this area. Toledo and Cleveland in Ohio are served by the company, as well as Buffalo, N. Y.

Beryl and Mica

THE OPEN-PIT OPERATIONS of Beryllium Mining Co., Inc., Gunnison, Colo., were recently described in a feature article of *Engineering and Mining Journal*. It is an account of how ore is extracted from pegmatite deposits which cover an area approximately 4000 ft. in length and 2500 ft. in width. The deposit is composed mainly of graphic granite and quartz albite, but at present, neither of these minerals is being mined except where necessary to gain access to the pods or cores of more important minerals which, listed in order of importance, are: potash, feldspar, scrap mica, beryl, columbite-tantalite, monazite and samarskite.

All mining is done by open-pit methods and, wherever possible, the minerals are mined directly from the working face before blasting is done to prevent shattering. Although most mining from the face is done by hand, sometimes it is necessary to drill a shallow hole close to a beryl crystal and ¼ to ½ stick of dynamite is used to dislodge the crystal from the surrounding quartz. After loose material has been sorted, it is bulldozed to the stockpile where it is run through the mill for additional mica recovery. The beryl crystals are easily broken into small pieces if roughly handled so their recovery is a rather slow process. The mica pieces are too small to be recovered by hand sorting so are recovered for the most part by the mill. All mica recovered from the screens is fed into a storage bin, and the minus 6-mesh fines are stockpiled. Approximately 90 to 95 percent of the mica is recovered as scrap mica, the balance going through the fine screens. The mica mill at present is being rebuilt to handle larger capacity and to improve recovery.

In the past, pegmatite dikes were often mined for just one mineral and then abandoned after that mineral became exhausted, but the present trend is toward the recovery of as many commercial minerals at one time as possible, as is practiced by the Beryllium company. In order to get at the rarer and more profitable minerals, considerable tonnages of dike material have to be removed, and the more of this tonnage which can be sold, the more profitable the operation. A recent development at the Beryllium property has been the opening of a new beryl deposit lower on the mountainside. Here the beryl is much cleaner and harder than that found in the upper dike. Thus far, the new deposit has yielded about 15 tons of beryl.

Building Products Meeting

THE AUTOCLAVE BUILDING Products Association held its annual convention April 2-4, 1951, at the Hotel Statler, Washington, D. C. Producers of sandlime products and concrete products were present. The convention program included discussions on high-pressure steam curing of concrete units and of lightweight sand-lime products. New officers elected were Elmer R. Coats, vice-president of Mutual Materials Co., Seattle, Wash., president; and Dale Cobb, sales manager of Century Brick, Monroe, La., secretary-treasurer.

Seated at the speakers table are (left to right) L. W. Hayes, Kansas City; Henry A. Hushke, managing director, Agricultural Limestone Institute, Washington, D. C.; Dr. J. W. Hudson, Columbia; Ben P. Donnell, Bonne Terre, new president of M.L.P.A.; J. J. Griesemer, Billings; Robert M. Koch, executive secretary of National Agricultural Limestone Association, Washington, D. C.; K. G. Harmon, Soil Conservation Service, Columbia, and Merl Hamill, Canton

These smiling gentlemen are the new board members of M.L.P.A. Left to right they are Buford V. Everett, Plattsburg; Kenneth Kilkenny, West Plains; Carl Partin, Milan; Ben P. Donnell, Bonne Terre; Russell W. Hunt, Neosho; Harry Andrae, counsel, Jefferson City, and E. M. Markwell, St. Louis

Missouri Limestone Producers Discuss Industry Problems

MEMBERS AND ASSOCIATES of Missouri Limestone Producers Association quite lavishly entertained themselves, their friends, and family members in Jefferson City, March 28-29, when that organization held its sixth annual convention. Reports after the conclusion of events would lead to the belief that the meeting was "bigger and better" than ever.

The banquet speaker, Dr. Jay William Hudson, for 37 years chairman of the department of philosophy, University of Missouri, and currently visiting professor of philosophy at Stephens College at Columbia, literally held his audience in the palm of his hand and according to most folks was the outstanding single feature of the convention. He spoke on "This Is America" in which he pointed out that America's form of government has endured 164 years—that it is the oldest existing form of government on earth. He challenged the thinking of every person in his audience by mixing his humor with philosophic viewpoints in a most delightful manner.

Role of Magnesium

Dr. E. L. Clark, Missouri State Geologist, discussed magnesium, which he said was rapidly coming to the front as one of Missouri's most valuable minerals. Its significance to chemical and industrial fields has been known for many years and rather recently it is becoming widely recognized as an important mineral nutrient for human development as well as for the production of livestock and crops. Dr. Clark pointed out that magnesium is located in the earth predominantly in a region 400 to 800 miles beneath its surface and that out-croppings are interspersed over the earth's crust. He said that Missouri is fortunately located because the dolomitic outcroppings are abundantly located in the southeast two-thirds of the state.

Blasting

A very comprehensive discussion of characteristics of tremors and vibrations was made by Jules E. Jenkins, Vibration Measurement Engineers, Chicago, Ill. He demonstrated a portable seismograph developed by his firm, a machine which measures and photographically records all vibrations to which it is exposed. Mr. Jenkins said that at least 98 percent of all claims involving vibration and tremors are without any basis.

Association Report

Paul N. Doll, M.L.P.A. manager, presented his annual report which showed that members in the association had produced about 70 percent of the state's total agstone output in 1950, and that emphasis on quality production was showing results because only one-fourth of the total deficient PMA tests in the state were made by members of M.L.P.A. Business and promotional affairs of the group were thoroughly discussed.

Both national agstone associations were represented at the Missouri convention. Henry A. Huschke, managing director, Agricultural Limestone Institute, and Robert M. Koch, executive secretary, National Agricultural Limestone Association, were present and discussed affairs in Washington affecting the limestone industry.

Outlook

Proposed Missouri legislation was discussed by John H. Hendren, partner in Hendren and Andrae, M.L.P.A. counsel, and Milton Duval, chairman, House Roads and Highways Committee. Of particular importance to the limestone business is this year's legislative proposals affecting increased gasoline taxes, increased truck license fees and truck operating permits.

Missouri's PMA program and a look into the future of agricultural limestone as a conservation material was very effectively presented by Martin Behymer, conservation materials section of the Missouri Production and Marketing Administration. He believed that agstone will be foremost among conservation materials in 1951 as it has been every year since 1936. Furthermore, Mr. Behymer believed that agstone will be retained as an approved conservation material for many years to come in Missouri.

Directors

Four men were elected to the 9-man board of directors. They were Carl Partin, Milan; Russell W. Hunt, Neosho; Keith Hall, Bunceton; and Buford V. Everett, Plattsburg. The first three listed will serve full 3-year terms and Everett will complete the unexpired term vacated by the resignation of Tom Clark, Clark and Runquist Construction Co., Savannah,

(Continued on page 100)

Silica Producers Discuss Car Supply

Hold special meeting because of car shortages and to bring up to date status of government controls

NATIONAL INDUSTRIAL SAND ASSOCIATION held a special meeting of its members at the Willard hotel, Washington, D. C., on March 12. The meeting was called by the executive secretary, V. P. Ahearn, after consultations with the president of the association, Sterling Farmer.

The purpose of the meeting was to afford members an opportunity to discuss regulations and controls growing out of the mobilization program. This entailed discussions, informal in nature, relating to priorities and allocations. Authoritative men from the Office of Price Stabilization and from the Defense Minerals Administration were introduced to the membership.

The subject of car shortages was also discussed by a representative of the Association of American Railroads and other guests.

The meeting was well attended with a geographical distribution that covered the more important industrial sand producing states east of the Mississippi river. There were about 35 men at the meeting.

The meeting was presided over by Sterling Farmer. The first informal talk was by William W. Collin, Jr., traffic counsel for the association. Mr. Collin briefly told of the status of the bonded sand case that began public hearings in the middle of March. He indicated that the examiners may issue a decision within two to six months.

Military

Ken Tobin, assistant to the executive secretary, brought the group up to date on the subject of selective service. He said that the subject of reserves was a greater problem than selective service. He emphasized that claims for deferment must be filed before a man is classified and that the amount of time was limited. No forms or special procedure are specified in the case of draftees so a request can be made in a letter.

On the subject of reserves, Mr. Tobin said army reserves were being called at a slower rate than reserves in the Navy or Air Force. If a reservist desires deferment, forms are available at his unit's headquarters. So-called "hardship deferments" are currently being issued by the Air Force to reservists with four or more dependents. The Navy may make recommendations in such cases but makes no promises, and the Navy defers enlisted men only if they come under the hardship category. A six months' deferment for industrial cases is evidently the rule and these can be reviewed.

It was pointed out that the Navy was calling a greater percentage of its reserves than other branches of the service and that enlisted men were handled on a local level. The situation in the Air Force was more confused because of an all-out call that was later qualified.

In the discussion, Marcus Wright III asked if a man classified 1-A could file a request before his physical. The answer was "yes." In these cases local boards have power to act.

A. Y. Gregory asked if there was a form to put into the hands of reservists. It was said that reservists must wait until actually called before filing deferment claims and the time is often short. Processing time in such cases can be 10 days or so but one instance of 72 hr. was cited.

Mr. Ahearn said data relating to whom the employer shipped was desirable information to accompany filing papers. Also an explanation of what is now currently being shipped, how the industrial sand is used, and who gets the end products might be helpful to the applicant. He suggested a personnel inventory of all employes so as to be prepared.

Mr. Tobin told of one instance where a prominent rock products operator, a Navy reservist with enough dependents to place him well in the hardship category, was called. The man came to Washington, D. C., but it turned out that the reservist had neglected to keep the Navy informed of his family status. He was allowed to resign. Financial status of a man can be a factor in accepting the resignation of a Navy reservist.

If an employe or employer wishes a deferment, one of the worst approaches is through political influences as resentment can develop very rapidly if that angle is used. However, it was pointed out that if one does come to Washington, D. C., there is no reason why he cannot contact his congressman or senator for directives on who to see, for these representatives can often put one in touch with the proper authorities. It was said that the Navy was flooded with reserves and reserve applicants. One member pointed out that the industrial sand producers were too small a group to get trained men—they had to train the men at their own plants if production of a necessary defense mineral were not to suffer. Another said that photostatic copies of purchase orders along with personal talks with board members was desirable in deferment cases. In many cases board members have no idea of the role played by foundry sand in the defense requirements.

The chairman said that any members wanting information on this subject should contact Ken Tobin, and the latest information would be made available.

Car Supply

On the subject of car supply, V. P. Ahearn led the discussion on car supply both with regard to the immediate situation and the long range picture. He summarized the long range picture by saying that the trend has been to retire more cars each year than are built. Courtner M. Hardy thought car shortages were mostly a result of poor distribution. He also pointed out that car builders were not using all the steel allocated to them and suggested that an appeal be made to them to correct a serious situation.

Mr. Ahearn gave some car statistical data as follows:

During January, 1951, there were 5448 new cars of all types installed and 4369 retired. In February, 1950, there were 47,000 cars awaiting repairs and 24,000 on February 1, 1951. In the 12-month period from February 1, 1950, to February 1, 1951, there were 8000 gondolas installed and 17,500 retired, 4700 hoppers installed and 21,000 retired.

The cars on order showed a decided increase during this same 12-month period, for in 1951 there were 51,700 box cars on order whereas a year ago there were only 7500. Gondolas: 30,500 on order now and 3200 a year ago. Hoppers: 33,000 on order now and 3000 a year ago. There were 132,500 cars of all types on order now compared to 19,000 a year ago.

It was pointed out that due to iron ore shipments from off-shore points, car dislocations of major proportions are developing. Export of grain to foreign areas in large amounts is also causing car disturbances on such a large scale that the above figures may not bring the relief expected. It was pointed out that car requirements were up 63 percent.

One member said the railroads were responsible for the present predicament and showed a total lack of foresight during the years 1948-49. It was pointed out that the industrial sand business was a good barometer of the nation's business, so car shortages in the industrial sand group indicated a general picture. It was asserted by some that the railroads have not kept up roadbeds and stocks. Results of the mid-winter "work stoppages" are still

(Continued on page 102)

EVALUATION AND DEVELOPMENT OF KILN EFFICIENCIES

Part II. Capacities and kiln dimensions considered in relation to fuel efficiency

By VICTOR J. AZBE*

IN THE FIRST PART of this series, the principal, main kiln heat losses were discussed generally, using a rotary kiln consuming 10,000,000 B.t.u. per ton as a bad example. It was developed that the maximum attainable fuel ratio, based on available heat and 100 percent CaO lime, was 9.2:1, but that actually a ratio of only 2.78:1 was attained.

The responsibility for the tremendous loss was specifically assigned to the main sources, these being the "calcining zone terminal temperature differential," "radiation," "nonrecuperative cooling of lime" and "excess air." "Incomplete combustion" can also cause a high loss but in this case it was not considered since excess air was featured.

A "lime balance" was developed to distinguish it from "heat balance" and each loss was charged with the specific amount of lime production loss for which it was responsible. This brought out, surprisingly, that the terminal temperature differential caused 85.7 percent of lime production loss, radiation 72.6 percent, nonrecuperative lime cooling 50 percent and that only as little as 10 percent of excess air caused a loss of 14.8 percent based on actual output of lime.

Unusual Kiln Test Procedures

During the many years of the writer's career in the lime industry, he has had the opportunity to study many rotary kilns of various characteristics. In every case, his approach has been that of an analytical combustion engineer, so the tests in all cases were more thorough than ordinary rotary kiln tests are apt to be. In some few cases this has been carried to great detail. The kiln was, so to speak, dissected and studied piecemeal, section by section, while in operation. This is the approach which one or two engineers have used to get information from cement kilns but we know of no one who has applied it to lime kilns. We certainly do not know of anyone who has had the opportunity to correlate such information as obtained from different kilns, both short and long, and of low and high capacity.

For such work it is necessary to have openings for test purposes located at strategic points, leading through the shell into the kiln. Gas samples are taken as are temperatures of the gases, wall and material, and samples of material are also taken. Special gas sampling tubes, high velocity thermocouples and optical pyrometers are used. The material samples are later fractioned for size and each size is analyzed separately. Then, all of the information is plotted against the kiln length and the points are the basis for curves and charts. In this way temperature and quality gradients are obtained for the entire kiln length, somewhat like that shown in Fig. 5.

It is only such work that is likely to provide the desired intimate knowledge of a rotary kiln's performance. Knowing conditions at the two ends of a kiln alone is not sufficient. When obtained from only one kiln even more detailed knowledge has its limitations, but when data are obtained from different kilns of dissimilar arrangements and size, operating under various conditions, then a broad field opens, allowing all sorts of productive theorizing since the data are based on actual tests and their interpretations.

It then becomes possible to visualize a portion of one kiln which happens to function particularly well in combination with another portion of a different kiln and thus to assemble piecemeal a new unit of superior performance, in theory at least, which then can be gradually translated into practice.

The translation into practice is never simple, but it would be more difficult if the goal set through the above procedure would not be so plainly in sight. It requires determination, the support of company executives and cooperation of the operating staff, but the stakes are high and the effort is well worth it.

It is not a matter of combustion nor that heat is not available, but it is because heat is wasted that more lime is not made. In a nut shell, reducing the heat waste and improving the heat transfer is all that is necessary.

A rotary kiln, and for that matter a vertical kiln, is not just one unit. The functions of the cooler and the calcining and preheating zones are distinct. They work at different degrees of perfection. Their performance is governed by different factors, which should be evaluated and manipulated separately and independently.

In the case of one kiln, the cooler may perform at its best. In the case of another, it is the calcining zone; in the case of a third, the preheating zone. In one plant, the fuel system may be good while in another plant the exhaust system might stand out. Then, in each of these five divisions there may be many sub-items which may be bad, good or excellent. These can then be weighted and, in the ideal at least, we could take the cooler of one kiln, combine it with the calcining zone of another and with the preheating zone of still a third. This is not always possible but at least it creates an understanding and some sort of a goal for direction.

There must be "understanding" above all. With understanding lacking, expansion likely would be expressed in enlarging something which is already big rather than in adopting something which is smaller and more effective. Making kilns 400 or more feet long, which do not produce more lime for any less fuel than kilns half the size, is an example. Even a kiln of half the size might be found to be oversize if rationalization would be carried through. Length of kiln has value only when efficient operational practice is lacking, as we propose to demonstrate.

Diagnostic studies of operations reveal that there is much that one could do to improve performance of any kiln now in operation whether it be calcining sludge or lime or be producing dolomitic sinter or cement clinker, but improvement to the greater extent is only possible in the case of new kilns. In the case of old kilns, the various idiosyncracies are often difficult to correlate. For example, too great a kiln inclination is in opposition to the desired high load and high kiln rotation. Excessive diameter is detrimental to reduction of radiation loss and the incorporation of inserts. Excessive length may become an idle burden since, if preheaters are installed, it would be foolish to have them at the end of such a kiln. In the case of a 400-ft. kiln, the preheater would likely be located near the 200-ft. point, leaving half the kiln length rotating ineffectively on the rollers.

Desirability for High Rotary Kiln Capacity

It has been stated that the aim is reduction of the main losses of the

*Azbe Corp., St. Louis, Mo.

heat of high elevation; that is "terminal differential," "radiation," "cooler," "excess air" and "incomplete combustion" losses. That means reduction of these heat losses and their direct conversion into lime. Unless the saving is taken out in kiln capacity, the benefit will be greatly minimized by virtue of radiation loss which will increase in proportion for the remainder of the fuel burned. It is for this reason, in addition to the normal economic reasons, that kilns should be operated at or close to maximum capacity.

But, what is maximum capacity? There are only very hazy ideas as to what a kiln should do. In the technical literature, and even in manufacturers' catalogs, the 9- x 175-ft. kiln is still listed at a capacity of 150 tons of lime per day.

We certainly had more to do with the development of high-capacity vertical gas-fired kilns than anyone else. Ten-ton per day kilns have been converted to produce 40 and 50 tons per day. The records of Dominion Lime, Ltd., with 10-ft. diameter kiln shells producing 45 tons of lime or a Texas lime company with 11-ft. kilns producing 50 tons of lime per day from unfavorable stone, substantiate this.

But vertical kilns are more responsive than rotaries in this respect. They have ample "active" working heat absorbing surface and all that is necessary is to force this surface. In the case of the rotary, however, there is surface, but it is inactive. The active surface is definitely limited and, besides, there are other factors which control rotary heat transfer. Heat transfer by "convection," (vertical kiln) can be far more readily manipulated than heat transfer by "radiation" (rotary kiln).

A rotary kiln depends definitely on radiation for heat transfer. Including the wall and the lime surface, hardly more than 10 percent is transferred by convection as shown in the accompanying tabulation. The relatively low gas velocity and the very low surface friction, combined with the low exposed surface area, reduce heat transfer to the minimum, by the very means which only is really effective after combustion of the suspended carbon particle has terminated.

This bears on the problem of the rotary in many ways from which one important conclusion is formed and that is that the rotary should be pushed so that the radiant state is extended further down the kiln line. Another and very important reason is that, although external heat loss through radiation is increased slightly, in proportion to the additional capacity obtained, it is actually reduced greatly. Due to the combination of such influences, the capacity at which a rotary kiln is operated seems to have an effect on its thermal efficiency that appears out of all reason. While an ordinary 9- x 175-ft. rotary kiln without special stone preheating attachments would, at 170-ton daily capacity, demand about 10,000,000 B.t.u. per ton, the same kiln at 220 tons capacity would require about 8,000,000 B.t.u. per ton. Fig. 6 gives the relationship of efficiency to capacity for five similar, simple kilns.

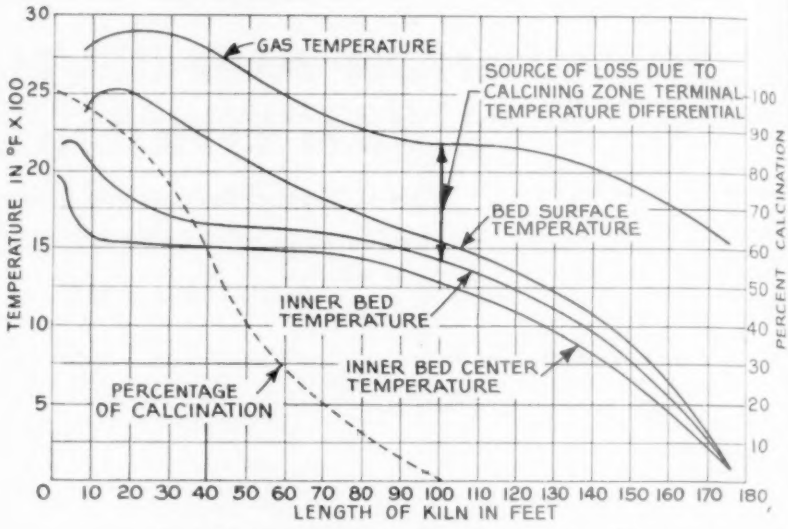


Fig. 5: Tempercture gradients of an unimproved rotary kiln

Heat Transfer Data

Rotary kiln, 9 ft. x 175 ft., 200 ton capacity
Nine million B.t.u. per ton of lime heat consumption
Eight foot internal diameter with 15 percent loading

Free cross sectional area	42.7 sq. ft.
Combustion volume $\frac{175 \times 42.7}{2}$	3718 cu. ft.
Heat release area per ft. length	14 sq. ft.
Total heat release area (24 x 175)	4200 sq. ft.
Total heat absorbing area (14 x 175)	2450 sq. ft.
Total external heat radiating area (9 x 3.1416 x 175)	4930 sq. ft.
External radiation heat loss at 1500 B.t.u./sq. ft./hr.	7,500,000 B.t.u./hr.
Lime production per hour	16,660 lb.
Heat to lime ratio, heating and calcination	2200 B.t.u./lb.
Heat to lime per hour	36,650,000 B.t.u.
Radiation per hour	7,500,000 B.t.u.
Total heat release	44,150,000 B.t.u.
Percentage radiation loss of heat transferred	17 percent
Heat generated per lb. of lime $\frac{9,000,000}{2000}$	4500 B.t.u.
Heat generated per second (4500 x 4.6)	20,700 B.t.u.
Products of combustion per 10,000 B.t.u. (7.6 lb. air + 0.7 combustion)	8.3 lb.
Products of combustion per second $\frac{20,700}{10,000} \times 8.3$	17.18
CO_2 from lime per second (4.6 x .785)	3.61
Mass velocity in lb. per sq. ft. area/second	20.79
Gas mass lb. flow per second	20.79
Mass velocity in lb./sq. ft. area/second $\frac{20.79}{42.7}$	.487
Corresponding convectional heat transfer B.t.u./sq. ft./hr./deg. F.	2
Temperature difference average through kiln	600 deg. F.
Total convectional heat transfer (2 x 600 x 4200) =	5,040,000
Total heat transfer from gas to wall and lime	44,100,000
Proportion of heat transferred by convection	11.4 percent

Basically, to make lime it is necessary to develop heat; the more heat the more lime. But to develop the heat, the fuel must be presented in the proper form to the proper amount of air and the two must be properly mixed. The mixture must be injected into a combustion space of correct volume and of proper effectiveness. Then, while the heat is being developed, it must be transferred, for which, in the case of rotary kilns, suitable radiant transfer characteristics are essential. Even after that is all satisfied, there is the matter of heat absorption surface of the lime bed or, indirectly, of the wall. Temperatures of these surfaces, area of active surfaces and their capacity to absorb the heat are all factors. There are very complex problems involved in the interpretation of all of this.

There are factors of the nature of the fuel, kiln proportions, kiln load, the sizing and calcining characteristics of the stone, kiln draft and kiln rotation. There are supplementary effects of coolers and preheaters and so on.

Some kilns rotate as fast as one rev-

olution in 35 seconds, and others as slowly as 3 minutes per revolution. In some kilns the bed rolls over, in others the surface shears and slides on the fines, while in other kilns it all slides. In some kilns of fast rotation, there is internal mixing while in others there is extreme size stratification to the point where the bed is virtually a solid strip slithering down the segment of the kiln with the internal layers being calcined purely by conductance.

When confronted with all this it becomes difficult to evaluate capacity. All we can go by is the performance of specific installations and from this establish the maximum rating. Our specific case will be a well-known plant with several 9- x 175-ft. rotary kilns. Many years ago, these kilns were fired with producer gas and a capacity of about 140 tons per day was obtained from each kiln. Later, pulverized coal equipment was installed and the capacity was raised to about 160 tons. Production was maintained at this rate for many years. It was assumed that this production rate was good because it was better than previously obtained and there was no other standard of comparison. All sorts of studies were made, but capacity was raised to only about 175 tons per day as a result.

Then I came on the job and on one of my many checkups of the kilns, with the Orsat and draft gauge, I got to wondering why the available draft was not being utilized. I wondered why more coal was not being burned and more lime made, which was so desperately needed at the time for the war effort.

Fortunately, the technical director of this concern, a highly progressive individual, was usually in sympathy with my aims. I suggested to "give it the gun" and, surprisingly, he agreed. He admitted later that he would never have dared to do it before.

So, the draft checks at the front and back of the kiln were opened wide, exhaust gas analyses were taken and the rate of fuel fed was raised in steps until the excess oxygen was eliminated.

The first night, the burner got scared and set the kiln back to a lower rate. The following day, we put it up again and established a record of 225 tons of lime per day which, in this case at least, was as simple to attain as that.

But, simple as it may have been, it was a historical event of utmost importance in the operation of rotary kilns. The kiln had no fan, no preheater nor a cooler of any sort. It only had an inclination of $\frac{3}{8}$ in. and was geared for high speed of rotation. In addition, it was heavily dammed at the discharge.

Capacity in 1941, before the change in 1942, was 60,567 tons or 175 tons per average working day. In 1943, the next full year's record was 78,868 tons

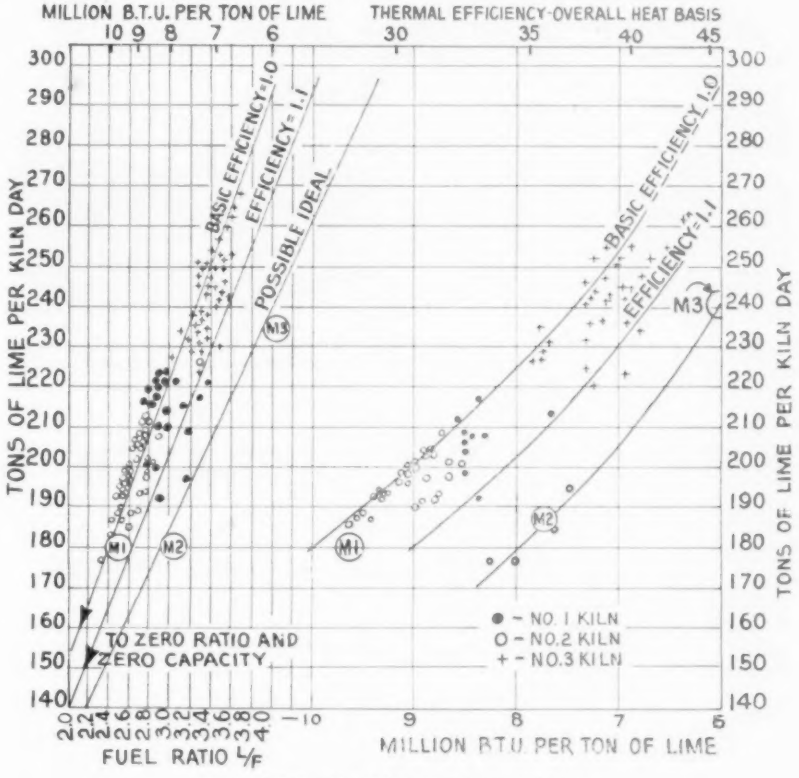


Fig. 6: Relationship of kiln capacity to efficiency

or 233 tons per working day, representing an increase of 68 tons per day. On some days, 250 tons was approached and that, for a kiln of 8790 cu. ft. internal volume, is 35 cu. ft. per ton of lime.

It is this 35 cu. ft. which we now assume to be the upper practical limit for a normal size of rotary kiln today. Fig. 7, on which the dots represent

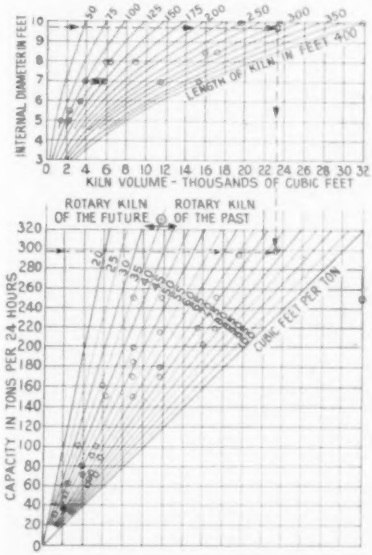


Fig. 7: Relation of rotary kiln volume to capacity

actual kilns, indicates that in the case of larger kilns volumetric production efficiency becomes less while in the case of smaller kilns it tends to become better, whereas only in a few cases does it reach the 35 cu. ft. line, even when there are preheaters and coolers incorporated into the system.

So there must be something wrong, for when there is a preheater more production should be obtained if the installation is such that the kiln must not be held back to avoid burning up of the preheater. If there is a cooler, again more production should be obtained if the cooler is truly effective. The preheater, particularly, should have an influence on capacity because it contributes additional active surface for heat absorption, lack of which is the main handicap of the rotary kiln.

But there are so many operating factors that it is quite readily possible to transfer a loss from this to that factor, reducing one and increasing another, such as placing the preheater at the end of the kiln and increasing radiation over the entire length. What that does is to establish a long, hot idle zone in the kiln such as all kilns that are too long have in their mid-length.

If a kiln of the simplest arrangement and with minimum heat absorption surface has been capable of producing lime at a 35 cu. ft. per ton rate at fair thermal efficiency, that is a definite indication to us that a kiln

(Continued on page 104)

Overall view of D. D. Ruxton Co., Inc., sand and gravel operation at Ludlow, Mass. Photo was taken from edge of empty basin where return water can be seen in foreground

New plant of D. D. Ruxton Co., Ludlow, Mass., has latest in individual electrical controls and safety devices for power equipment

PUSH-BUTTON OPERATED GRAVEL PLANT

By EDWARD F. PERREAULT

THE RECENTLY COMPLETED sand and gravel plant of the D. D. Ruxton Co., Inc., Ludlow, Mass., which started operation last June, marks a new era in electrical engineering design for simplicity of operation.

Designed and built through the combined efforts of the D. D. Ruxton Co. and the New England Road Machinery Co., South Boston, Mass., the plant employs a one-belt conveyor system with push-button control that can be operated easily and is capable of turning out from 56 to 156 tons of material, depending on the speed at which it is operated. This plant lays claim to being one of the most unique sand and gravel plants in the country.

Credit is given to John Merkel, Ludlow contracting electrician, for engineering the electrical installation which incorporates individual motors for every operation, each motor with its own line starter switch and push-button control regulated from a central control panel.

Arrangement of control panel for push-button control. Reading from left to right, controls are: push-button reset relay switch with thermo-controlled multi-breaker at right. Two upper boxes are the bull screen and the feeder shaker control box. Both controls have independent line switches with push-button reset relay switches and automatic circuit breakers which permit operation of each circuit independently. Control boxes in lower half are conveyor belt, grading screen, washer, and water pump. Main switch box is at extreme right. Large block control box contains small transformers. Meter and light switches are directly above transformer box

Each unit in the circuit is designed with its own controls, operated independently and protected by multi-breaker switches which automatically opens the circuit if the line becomes overloaded. All controls were manufactured by General Electric and were designed with an on and off switch with a built-in circuit which is thermo-controlled. The automatic starter is also thermo-controlled.

Electrical energy secured from a transformer station adjacent to the plant is hooked up to the control room via underground conduit pipe. The power line is 480 volt, 3 phase, 60 cycle current, and connects with the main fuse box in the control room. The control panel has a 16-ft. panel board on which are mounted individual push-button and reset relay control units. The manipulation of the electrical set-up can be taught to anyone after brief instruction.

In all there are seven individual motors, each of which controls an operation. All were manufactured by Allis-Chalmers Mfg. Co. American reduction units are hooked up with the motors and geared to produce a 13:1 ratio with multiple V-belt drives. As an added measure, all wiring is carried through underground conduit pipe.

Eugene J. Guidi, president of Ruxton Co., indicated that the main feature in designing the sand and gravel plant was to create an arrangement that would overcome difficulties usually associated with chain or regular belt-driven and gear-operated machinery. An innovation in design was the building of a type of bull screen which is incorporated in the mechanism.

"We designed a bull screen that was

raised 21.6 ft. above ground," Mr. Guidi explained. "By doing this we were able to eliminate a second conveyor belt, thereby reducing our maintenance cost. By utilizing a multiple V-belt drive with reduction units we lessen the frequency of breakdown. The use of individual motors controlled from a central panel has also eliminated the possibility of major breakdown," Mr. Guidi concluded.

Four men are employed in the sand and gravel operation of the plant. A control man handles all mechanical operations of the plant from the control room which is located in a small building on ground level. He supervises the operations of the other men from his position, so as to maintain a steady flow of material entering and leaving the plant. The other men employed include a shovel operator, a truckman, and a man to empty the bins and look after the various operations.

The raw material dumped into the 20-cu. yd. hog box is fed through an automatic feeder which can be operated at four different speeds. The bull screen separates the rock and transfers it via a separate chute to the crusher. After crushing it is dumped on the conveyor belt with the sand and gravel.

A rubberized conveyor belt 18 in. wide and 115 ft. long, a product of the Hewitt Rubber Co., Buffalo, N. Y., then carries the material to the top of the tower where the grading screen is located. This screen has six different sized openings, each 48 in. wide, which grades and dumps the material into steel storage bins below. The screen is approximately 24 ft. long and 60 in. in diameter.

A Fairbanks-Morse 3-in. centrifugal pump operating at 500 g.p.m. furnishes the water required for washing. The company has its own reservoir fed from natural springs, which has a capacity of 500,000 gal. per day.

Steel storage bins designed by the Harriman Steel Co., Holyoke, Mass., have a capacity of 450 tons. There are six of these bins, the company handling six different grades of material.

The Ruxton plant is located in an outlying section of the town on a 140-acre tract owned by the company. It has an abundance of raw material and a water supply more than adequate for its needs. The plant has attracted considerable attention on the part of many in various parts of the country, who have come to observe the efficiency of this modern sand and gravel operation.

Probably the most significant feature, apart from its ease of operation, is the engineering design incorporated for maximum safety and for preventing accidents. Because of individual electrical control circuits it is virtually impossible for the plant to suffer a major breakdown. Overloading, a common occurrence in an operation of this kind, is further reduced through automatic circuit breakers built into each circuit. Should anything go wrong with one motor or the line be overloaded, the control man is able to trace the trouble immediately. Since each line is an independent circuit, none of the other motors are affected by the overload, unless the trouble originated from the main fuse box, which contains the only fuses in the installation.

The seven Allis-Chalmers motors used to provide power for the Ruxton sand and gravel plant are as follows:

One 50-hp. motor to operate the stone crusher.

Three 10-hp. motors, one to operate the belt conveyor, one for operation of the grading screen and the other for the worm feeder.

Two 5-hp. motors, one to operate the bull screen and the other to operate the feeder shaker.

One 20-hp. motor, used to operate the Fairbanks-Morse water pump system.

Operating instructions are as follows:

Starting

1. Starting water pump
2. Washer
3. Grading screen
4. Conveyor
†5. Crusher
6. Bull or scalding screen
7. Feeder

Shut Down

1. Feeder
2. Bull screen
3. Crusher
4. Conveyor
5. Grading screen
*6. Washer
7. Water pump

†In cold weather, crusher is started first and allowed to run 10 to 15 minutes to warm up.

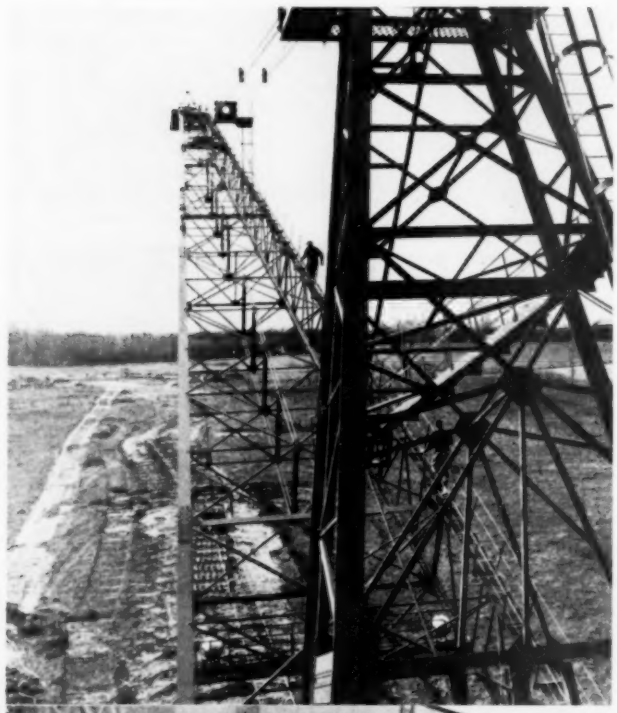
*Washer must be cleared before shut-down and is kept running until nothing comes from discharge.

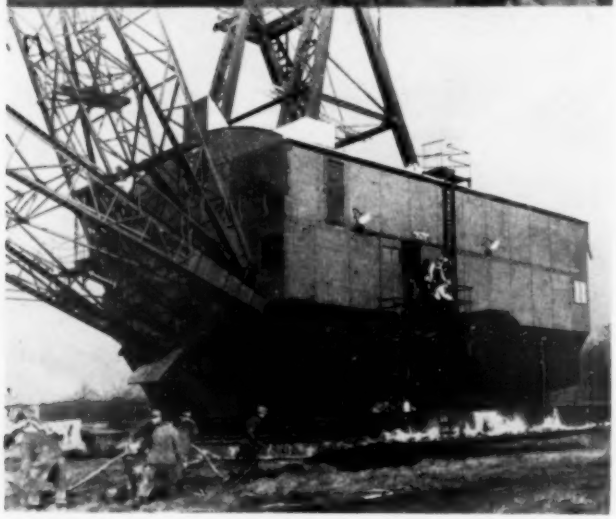
Officers of the D. D. Ruxton Co., Inc., are: Eugene J. Guidi, president; Don Ruxton, vice-president, and Alexander Birnie, secretary-treasurer.

Eugene J. Guidi, president of the D. D. Ruxton Co., Inc., of Ludlow, Mass. Photo was taken at a point below catwalk leading to grading screen tower

Grading screen in operation. Note four grades of screens. Heavy screens are at extreme end. Motors not shown are situated on the opposite side

The swing cycle of the boom is 56 seconds and maximum hourly output of the dragline is 512 cu. yd.





STRIPPING WITH

Carbon Limestone officials are, left to right: P. E. Heim, vice-president for sales; George Donaldson, vice-president for production; F. B. Thatcher, president, and Urban Masson, superintendent

REMOVAL OF OVERBURDEN is a big job in the limestone-producing area in and around Hillsville, Penn., where a ledge of stone approximately 20 ft. thick is covered with 70 ft. or more of topsoil. Plants in the area have large capacities, necessitating the handling of great tonnages of material at low cost in order to keep ahead of quarry development. Practice is to use large-capacity draglines and the trend has been to increasingly larger sizes of these machines.

Carbon Limestone Co., Youngstown, Ohio, placed into operation, at Hillsville, Penn., on February 5, one of the largest draglines used anywhere in the crushed stone industry. It is operating on a 24-hr. schedule in removing 70 ft. of overburden.

This dragline is a 650-B dragline excavator manufactured by Bucyrus-Erie Co.; it has walking traction mounting and is equipped with a 235-ft. boom and 10-cu. yd. dragline bucket. The machine proper weighs 850 tons and has 137 tons of counterweight to balance the boom.

It is designed to operate from 3-phase, 60-cycle, 4000-volt power, with Ward-Leonard controlled motor-generator sets furnishing direct current for the motors.

The 850-ton machine has walking traction mounting and operates from 3-phase, 60-cycle, 4000-volt power

To remove the 70-ft. overburden from the limestone deposit, this dragline operates 24-hr. per day schedule

Extending upward at the left is the 235-ft. boom. There are 137 tons of counterweight to balance it

Twin drag ropes are connected to the sides of the bucket to aid in effecting a direct digging stroke

0-cu. yd. DRAGLINE

There are two drag motors, two hoist motors, three swing motors, and the two motor-generators are rated at 650 hp. each. Swing cycle is 56 seconds and maximum hourly output is 512 cu. yd. Length of the step is 7 ft. 4 in. and the diameter of the tub is 36 ft. An operator, oiler and ground man are required to operate the machine. It is said that 56 railroad carloads of parts were required to assemble the dragline.

A feature of the design is the use of twin drag ropes. One is connected to each side of the bucket, affecting a direct digging stroke by applying greatest power to the side of the bucket encountering the most difficulty in the bank. The hoist and drag drums are independently driven through the Ward-Leonard motor-generator control which produces quick response, smooth acceleration and deceleration, and flexibility of operation. The hoist, swing and crowd motors are of the power regenerative type, providing the operator with control of motion without operating brakes or clutches.

Carbon's older dragline is also a large capacity unit, a 9-W Bucyrus-Erie of the walking type which has been in operation since 1940. This machine has a 200-ft. boom, an 8-cu. yd. bucket, is operated on a 60-second cycle and has a maximum output of 360 cu. yd. per hr.

A LOGICAL APPROACH TO ACCIDENT PREVENTION

New York producers in limited area scrutinize plant operations for hazards as part of safety program

By C. A. GUSTAFSON

IN NOVEMBER OF 1949, while discussing a proposed safety program with Alfred Hoftiezer of Laverack & Haines, Inc., insurance managers, Buffalo, N. Y., he mentioned that he had about 100 pictures of hazards in quarry operations. The thought came to me that other quarry men would be interested in seeing these pictures, thus giving them ideas for guarding equipment, training, etc., as well as a chance to discuss the problems involved.

The mechanics of getting a group together to see the pictures were discussed and we decided to invite all producers within a 100-mile radius. We wrote to all quarries, cement plants and sand and gravel concerns, asking them to be represented at an organizational meeting at which time we would explain the plan and show some of the pictures to them. Representatives from seven companies, representing 13 plants, attended. We made it a dinner meeting with each company paying its share.

John Kawaske, general superintendent of The Callanan Road Improvement Co., South Bethlehem, N. Y., who perhaps is the "dean" of the quarry operators in this area, kindly consented to serve as chairman. We decided to divide the pictures into five groups for purposes of study, taking one month for each. We placed them under the following categories: "Maintenance," "Heavy Equipment," "Trucking and Hauling," "Mill Machinery" and "Drilling and Blasting." The pictures were 35-mm. transparencies so they could be shown on a screen. We also had an alternative program, which consisted of a sound-slide training film put out by the National Safety Council.

The original idea I had in mind was to bring shovel runners, bulldozer operators and other operating men to the meeting when the time came for consideration of heavy equipment, mill men for the meeting devoted to mill machinery, etc. The first meeting, however, was to be attended by the top officials only, who would decide which type of program was to be used. A selection of pictures was made from each of the groups and the first of the sound-slide films was shown so that those present could get the idea we had in mind. The idea was received enthusiastically and it was decided that the whole program should be held for supervisors and top officials only. They also wanted both programs to run simultaneously. Fourteen meetings have now been held and the subject matter decided on for the originally scheduled five meetings has not as yet been covered. The reason for this is that during the interim several timely topics have arisen so we have considered them as they came up and merely postponed some of the original ideas. For instance, when the new New York State Quarry Code (Rule No. 17) came out we invited Messrs. W. K. Kollack and L. F. Worsell of the New York State Bureau of Mines to attend our meeting that month and explain the changes and new regulations.

After each meeting, a condensed version of the proceedings was written up and mimeographed. These were sent to each producer in the area whether or not he attended the meeting. Through this medium, many "converts" were brought in as they found, through the reading of these minutes, that the men present were sincere and were actually accomplishing a great deal.

Plant Inspections

During the summer months it was decided to hold plant visitations rather than meet indoors. Four such visits were made, covering three crushing plants and one cement mill. The group met at 10:30 a.m. at the plant to be inspected and the rest of the morning was spent in examining the ledge, drilling operation, and the shovel and hauling operation. Luncheon was usually held at a nearby restaurant or hotel, with the company whose plant was visited being host. After luncheon, the shops, storerooms and plant proper were inspected. After the inspection a round table discussion was held and all danger spots and the various hazards observed by the group were brought to the attention of the plant management. It goes without saying that each man present also noticed the places that were exceptionally well-guarded and picked up some practical ideas to bring home with him. Our plant at South Bethlehem, N. Y., was one of the plants visited and five danger spots were noticed that had existed for years. In fact, we had lived with them so long that we did not even recognize them as hazards. My face was a deep crimson when they were pointed out to me. Similar experiences were encountered at each plant visited. The way it worked out, it was the same as having 20 to 30 superior type of inspectors go through the plants since each visitor was a man who worked in the same line day in and day out.

We found that the best way to inspect the plants was to divide the group into small units of four or five men and to provide each group with a guide from the plant personnel. I cannot speak too highly of these plant visitations. At each plant visited the men came away feeling that they had learned something worthwhile to bring back and apply to their own operation. At this writing the members are considering the possible operations to be visited this year.

The general feeling is that there are no secrets in our business and that if someone picks up an idea (whether it be safety or operational) an idea in return is soon forthcoming.

I've noticed that a wonderful spirit of friendship and cooperation has developed among the superintendents and operating men, even among those of companies in direct competition with each other. It seemed to start out with individuals having a sort of mutual respect for each other but, as these meetings progressed, the feeling changed to that of friendliness, good fellowship and cooperation. It is not unusual to hear someone say, "Hey Joe, you use XYZ screens, how often do you grease them?" or to hear questions asked about babbitting, welding, crushing, blasting or anything concerning our daily business. This clearing house of information on operating problems alone has meant dollars to many of the members.

After meeting each month for a year, the score stood at five cement companies representing six plants, one slag company, two asphalt plants, two lime plants and 12 crushed stone producers, representing 24 plants, or a grand total of 19 companies with 37

plants. The attendance each month ran from 25 to 30 men present.

Organization

At the end of the year it was decided to organize this rather amorphous group into a formal organization. A committee was appointed to draw up a set of by-laws, a name and nominate a slate of officers. The by-laws as written are of such a general nature that any and all contingencies can be taken care of. There are no standing committees nor is there any bulky, unwieldy panel of officers, trustees, etc. The officers elected consist of president John Kawaske, general superintendent of The Callanan Road Improvement Co., South Bethlehem, N. Y.; vice-president, Seymour Fleming, safety director of New York Trap Rock Corp., Newburgh, N. Y.; secretary, C. A. Gustafson, superintendent of The Callanan Road Improvement Co., South Bethlehem, N. Y.; treasurer, Clarence Stetser, assistant superintendent of New York Trap Rock Corp., Clinton Point, N. Y.

There are three forms of membership. Regular members consist of producing companies, associate members are manufacturers of equipment who are interested in safety, and honorary members. The fee for regular and associate membership is a nominal $10 per year for a company, regardless of how many plants or men are represented. The honorary membership is gratuitous and is especially for selected men associated with the industry but whose employers are ineligible to become members or associate members, such as various state departments and insurance companies. From the low price of annual dues it can readily be seen the organization is not interested in profits nor is anyone paid a salary. The monies collected pay for printing, postage and dinners for speakers and guests.

Programs

The subjects covered have been interesting and profitable to the members. Typical subjects covered are "Maintenance," "Study of the New New York State Explosive and Quarry Codes," "Resumé of Accidents of Participating Companies," "Trucking and Hauling," "Blasting," "Study of New York Disability Law," "Horseplay" and "Mill Machinery." The resumé of accidents was held twice and was possibly the most interesting and instructive subject covered in the meetings held. As each accident was recounted, some other operator found an existing similar hazardous condition in his own plant that he hadn't realized existed. The method used to prevent a recurrence was told as a part of the report and this caused considerable discussion.

We have had a number of visitors from other parts of the state and even from nearby states. These visitors had heard about us and felt that they might be able to start similar groups elsewhere. At this writing I understand three such groups are in the making.

It has often been said that safety-conscious people are rabid on the subject and when one sees this group in action he can well believe it.

The dinner is called for 7:00 p.m. but, of course, it is nearer 7:30 when it starts. To save time, introductions of guests are made during the dinner courses and, if service happens to be exceptionally slow, each man is asked to rise, state his name, title and company. Before 8:30, the meeting gets underway and what little business there is to transact is disposed of in less than 10 minutes. The subject at hand is then started and never has the meeting broken up before 11:15 p.m. Surprisingly, we still find the group milling about and talking safety informally to each other for another 15 minutes or half hour. Recently, one company which sends four or five men over 100 miles to the meeting has taken a large suite for the night instead of two or three small rooms and, after the meeting, one can find from six to ten others with them in their suite continuing the discussion.

Another noticeable thing is that no few men dominate the discussions at the meetings. At first, a few reticent souls were quite timid in speaking up but, as the meetings have progressed, they have lost their timidity and now speak up strongly and clearly when they have something to contribute.

The New York State Crushed Stone Association has become interested in the group and Harry Hayes, secretary and engineering director of that association, usually honors our meetings with his presence. Hiram Barnes, president of the New York Crushed Stone Association, also has visited us. Indeed, we were singularly honored a short time past when both Mr. Barnes and Reid Callanan, president of the National Crushed Stone Association, attended a meeting.

Accomplishments

Everyone who attends our meetings seems to feel that we have come a long way in the matter of reducing accidents in our industry. While we have no practical yardstick with which to measure what has been saved in life, suffering and dollars and cents to the employe as well as the employer, we believe that when we learn of a hazard that we never knew existed and rectify it, that we have at least chalked up a zero on the accident score board. In my plant alone, I have been able to do that at least 11 times this past year. For the first time in the history of our company we went through an entire calendar year at one of our plants without a lost-time accident. In fact, the total score was 650 consecutive no lost-time days. I do not claim that this was made possible through membership in the organization alone, but I do feel that participation helped considerably.

I strongly urge companies in other sections of the country to join with their neighbor producers and form such groups. This type of area safety meeting is as much different from those area meetings put on by insurance carriers as night is from day. As crushed stone producers we are not interested in listening to the problems of the textile, chemical, rubber and other industries, but we are interested in the experiences of other producers of crushed stone. Safety can be made

(Continued on page 106)

The Author

Mr. Gustafson is well-qualified to write on the subject of safety and is a happy choice to serve as chairman of the Accident Prevention Committee of the National Crushed Stone Association. Educated at Rensselaer Polytechnic Institute, he is superintendent of the South Bethlehem, N. Y., plant of Callanan Road Improvement Co., which is headed by Reid Callanan, president of the N.C.S.A. Mr. Gustafson served in the Seabees in the South Pacific during the past war and has been a member of the U. S. Naval Reserve for ten years. He has had two articles on the subject of safety published in the U. S. Navy Civil Engineer Corps Bulletin. Above all, as an experienced operating man, he has that practical approach to the subject of safety that is needed to put it over.

President G. G. Treat and other long-service employes honored by Bessemer Limestone and Cement Co.

Part of the large group attending the Bessemer testimonial dinner

FIFTY YEARS IN THE CEMENT INDUSTRY

A TESTIMONIAL DINNER held April 2, in New Castle, Penn., provided the setting for honoring 50-year and other veteran employes of Bessemer Limestone and Cement Co., Youngstown, Ohio. Principally honored was the president of the company, G. G. Treat. The other employes with 50 years or more service were John Brentin, Sr., with 50 years' service; John Carlson, 55 years; Evert Kiminkinen, 51 years, and William Glassel, 56 years.

Mr. Treat joined Bessemer as a shipping clerk in 1901, becoming successively order clerk, bookkeeper, purchasing agent, general office manager, auditor and paymaster. In 1910 he was elected secretary and assistant treasurer, and in 1920 was elected treasurer also. His next rise was to vice-president and director in September, 1926. His present position was attained in December of that year.

Over 700 employes and their wives attended the dinner. W. E. Bliss, a director of the company, presided. R. E. Roscoe, vice-president, presented the awards to the honored employes. Those who served from 25-39 years received watches. Employes with 40-49 years' service were given watches with gold bands. The five who had completed 50 years with the company were presented with the gold band watches and a $100 savings bond. Mr. Treat received a little extra attention. The officers and directors presented him with a diamond ring.

When Mr. Treat joined the company, it was 14 years old. The company was chartered May 27, 1887, as the Bessemer Limestone Co. by a group of blast furnace operators from Youngstown and Steubenville, Ohio, and Wheeling, W. Va., for the purpose of producing limestone for flux. The overburden on the limestone deposit was found to contain a large amount of shale suitable for making brick. Two brick plants were built and operated until 1917, when they were sold to the Metropolitan Brick Co. of Canton, Ohio. This company still operates the plants.

In 1919 a cement plant was built, and a new charter incorporated the present company, The Bessemer Limestone and Cement Co.

The first president of Bessemer Limestone Co. was Joseph G. Butler, Jr., who remained in office until 1911. John Tod next became president and remained in that capacity until 1927. L. A. Beeghly followed and held the position until 1932. Charles Schmutz was then president until his death in 1936. Mr. Treat has filled the position since that date.

Bessemer has continued to grow. The annual report for 1950 contains statistics showing that shipments of both cement and limestone broke all previous records. In the field of accident prevention the company record has been outstanding. Several employes were honored last year by the Joseph A. Holmes Safety Association, Washington, D. C. The quarry men received an additional award for having worked from January 1, 1928, to January 1, 1950, a total of 3,192,453 manhours in handling 40,000,000 tons of limestone and overburden, without any fatality.

President G. G. Treat receives the congratulations of Bessemer employes

COMMENTS ON "IMAGINATIVE" CEMENT AND CONCRETE CHEMISTRY

By NATHAN C. ROCKWOOD

A VERY GOOD FRIEND, who knows far more physical or colloid chemistry than we can hope to acquire, having been a college professor of it, recently described our articles on cement and concrete research as containing some "highly imaginative" cement chemistry—although not disproved in the present state of knowledge. He didn't object to this, however, because he knows these articles are stirring up fresh interest and may lead to something "concrete" — using that term here in a literary sense. To those who remember an article (or articles) that we started off with, now some years ago, it may be recalled that we urged the newer generation of cement and concrete researchers not to be intellectually hog-tied by the ideas of their predecessors, but to use their own imaginations. Since example is better than precept, what is more appropriate than to provide an example?

There has been widespread interest in these articles, for we have had many verbal comments and some letters have been received from readers in various parts of the world outside of this country, as well as in it. Most of the comments are to the effect that we are raising pertinent questions that should be answered, and some comments have resulted in new ideas to pose in more such articles. We have been tardy in publishing all these views, partly because some letters were specifically not intended for publication, but for this writer's information only.

The problem of better or more durable portland cements, especially for pavement construction, is perhaps more serious than some cement manufacturers realize. It seems obvious that if we are to continue to construct pavements of concrete on the scale needed, we must learn to provide portland cements that can be safely used with aggregates that are readily available. We cannot be too choosey—as are the Army Engineers and the Bureau of Reclamation in the construction of their huge dams. In other words, the cements must be adapted to the aggregates to be used, and not an attempt to adapt the aggregates to the cement. This conclusion is merely logical, since the cement is the only *manufactured* product in concrete and therefore its qualities or characteristics are the only ones that *can be* changed.

The development of air-entraining cements (or concrete) and of low-alkali and low-heat cements is proof that the qualities of the cement can be changed, but these are probably not the final answers for pavement cement. The attempt of the Kansas State Highway Department to rediscover some of the good qualities of "old-fashioned" portland cements, and the use of cements blended with natural cements and with pulverized blast-furnace slags in New York State and elsewhere are other examples of attempts to adapt cements to the aggregates rather than the reverse. Undoubtedly construction practices must also be made to conform to the desired ends, but we believe the primary responsibility rests with the cement manufacturer if he would continue to maintain the large market for highway construction that he has hitherto enjoyed.

European Portland-Slag Cements

O. Rolfsen, a consulting engineer of Oslo, Norway, after expressing his interest in the articles and complimenting us on "open and broadminded reflections" on cement qualities, expresses the opinion that present portland cements are a "compromise" between a binding material (not the most desirable) and what the refractory lining of a rotary kiln will stand. The inference we get is that present portland cements under the conditions of manufacture contain more lime than desirable for best results, because a lower limed raw mix or higher temperatures would be destructive to the kiln lining through slagging. This is in line with a point made in these articles some time ago that with the advent of demands for "hard burned" clinker, manufacturers were compelled to go to higher-limed raw mixes to prevent fluxing of the clinker and damage to kiln linings. Many of our concrete troubles date from that period.

Mr. Rolfsen is convinced that the excess of calcium hydroxide in the hardened cement paste is responsible for much poor quality concrete. The simplest way to overcome this defect is to intergrind and blend pulverized granulated blast-furnace slag, and Mr. Rolfsen refers to much European experience to prove that concrete made with these blended portland-slag cements is more durable, particularly in sea water. There seems to be no dispute on this point in Europe now, but portland cement manufacturers there bitterly opposed the use of portland-slag cements for many years. Only in Great Britain and the United States apparently have cement manufacturers continued to be successful in preventing the adoption of such blended cements on a larger scale for many kinds of concrete, particularly for highway pavements.

Mr. Rolfsen was so impressed with the good qualities of a portland cement blended with pulverized granulated slag that he determined to make it in Norway, prior to World War II, but being unable to buy cement clinker from reluctant manufacturers was forced to make his own. To this end he designed and had constructed what he calls a "draft sintering" kiln (U. S. Patent No. 2,193,698) which is described as "a truncated cone rotating about an inclined axis, the sintering surface being formed by the external conical surface thereof." The grate bars are hollow and water-cooled. The mix of raw material and fuel is fed to the grates where various control valve mechanisms provide flexibility in the amount or degree of sintering accomplished, and the clinker is quickly and readily chilled on passing through the grate bars.

That much of a description is necessary to develop Mr. Rolfsen's theory that the clinker he makes in this type of kiln is composed of C_3S and C_2S crystals frozen in a glass matrix. In the form of glass any free lime or magnesia is apparently rendered harmless. He writes that tests at the Technical High School in Stockholm have shown that clinker with a lime saturation up to 114 percent is sound and stable if sufficiently burned. He claims to get the necessary degree of burning without actually fluxing the clinker, hence the grates of his kiln require no protection, and the calcining chamber, being water-jacketed, requires no refractory lining.

It is rather difficult for us to follow Mr. Rolfsen's thoughts through two long letters. However, he writes that his ideas of the hydraulic properties of granulated blast-furnace slag are based on Prof. Grün's theories that glassy slag is amorphous but has the inherent power of crystallization. This power is evidently developed by solution in or contact with lime water. Evidently being unable to obtain either portland cement clinker or imported granulated blast furnace slag in order to make a blend, Mr. Rolfsen

set about making a cement clinker that would combine the qualities of both. In other words this required a specially designed raw mix and the sintering device described. He apparently doesn't believe this can be done in a rotary kiln.

Activite (Calcite) Cement

Arne Daniels, Oslo, Norway, has written us in considerable detail about the excellent results with a portland cement blended with a certain variety of pulverized calcite. We have referred to this before, and there have been other references in American concrete literature, one in the *Journal* of the American Concrete Institute being rather uncomplimentary. Nevertheless, Mr. Daniels has sent us copies of reports by various Norwegian authorities which prove that it has been used successfully in some important structures.

Mr. Daniels also sent us as an exhibit a piece of concrete from a lead-lined concrete tank that had been used to contain sulfuric acid. The lead had probably reacted with the cement, which caused holes in the lining, permitting the sulfuric acid to come in contact with the concrete. The result was a surface coating of calcium sulfate, gypsum or anhydrite, which sealed the concrete against further penetration of the acid, so that below about three-eighths of an inch, the concrete was perfectly sound. He believes the resistance of his calcite-cement-concrete to sea water erosion is by a similar sealing of the surface with a new product resulting from the reaction of the lime carbonate (calcite) with sea salts. Also, in Norway, many of the river waters are acid, chiefly from humus acids. He finds that his calcite-cement-concrete resists erosion here better than straight portland cement concrete.

The only explanation thus far suggested for this resistance of calcite-cement-concrete to corrosive waters is apparently the one we suggested in our previous discussion of the subject (October, 1949) that the calcite crystals incorporated in the cement in some way "fix" the free calcium hydroxide, possibly by building up larger crystals of calcium carbonate, thus sealing the surface of the concrete, much as the "bleeding" of freshly quarried Indiana limestone seals the surface against weathering, even in city atmospheres loaded with SO_2 and CO_2. Certainly when the calcite, or calcium carbonate, dissolves, SO_2 and CO_2 are absorbed and if $Ca(OH)_2$ is present new $CaSO_4$ and $CaCO_3$ will be formed.

Anorthosite Corrective

Karl V. Vail, a consultant, Los Angeles, Calif., wrote us almost a year ago as follows:

"For the past three years, I have been engaged in research on the problem of alkali-aggregate reaction. During this time, I have been greatly assisted by the material on this subject in ROCK PRODUCTS and particularly by your excellent editorial comment. My work has now culminated in the discovery of an additive which appears to offer a definitive solution for the problem, and it has occurred to me that you might be interested in a resumé of my conclusions.

"The principal ingredient of my additive (upon which an application for patent has been filed), is altered anorthosite, a lime-soda plagioclase feldspar rock. A large deposit of this mineral is located in Soledad Canyon in the San Gabriel Mountains of Los Angeles County, Calif. This material is unique in that it is the only pozzolan practically available which is in itself non-siliceous and non-reactive. To insure rapid and consistent results, a quantity of calcium carbonate is added, and the whole, finely ground and thoroughly mixed, is employed as an additive or replacement in concrete. The most effective and economical proportions appear to be a replacement of from 20 to 25 percent of the cement.

"This material has been highly effective in reducing expansion. For example, a pyrex-glass-portland-cement-mortar bar (the normal expansion of which is from 0.5 to 0.6 percent in three months) when combined with this additive showed an expansion at three months of only 0.088 percent, of which 0.064 percent occurred within the first fourteen days. In an early test with carefully selected altered anorthosite alone, I found that the expansion of bars with a highly reactive sand has been negligible after eleven months.

"The material shows all of the other accepted indicia of an efficient corrective. It reduces the alkalinity of a sodium hydroxide solution 54+ percent, and a mortar bar in which it was used with a highly reactive sand showed a pH of only 11.65. Most significant of all is the fact that this same specimen bar showed, under microscopic examination, absolutely no silica gels, while comparable specimens in which a calcined shale additive was used were permeated with them.

"I enclose a copy of a report by Irving Sherman, of the United States Department of the Interior, on this last matter which I think you will find very interesting. It is possible that the unique method employed therein by him has at last furnished the industry with the quick test for potential reactivity which has been so greatly needed.

"It may also be significant to observe that, despite its ability to reduce alkalinity, we have definitely established that altered anorthosite exhibits no base exchange properties.

"Theorizing on the causes of this phenomenon is naturally difficult and complex. However, since this material produces a great reduction of alkalinity without containing any appreciable amounts of soluble silic , I am satisfied that its chemical action is different from that of any cure heretofore proposed for reactivity. I believe that it operates in a dual fashion, i.e.: (1) the hydroxides of aluminum and iron in the anorthosite, in the presence of calcium carbonate, absorb the alkalis in the mix, and (2) the calcium or carbon ions in the calcium carbonate, or perhaps both of them, combine with the silica ions in the reactive aggregate to prevent the formation of gels. In view of the absence of any silica gels as disclosed by Mr. Sherman's report, and the substantial proportion of the expansion occurring in the first fourteen days, it is my belief that even the relatively small expansion observed is not due to the alkali-aggregate reaction at all, but is an increase in volume resulting from the formation of carbonates.

"The material has superior strength characteristics. Used as a replacement for cement as indicated, it will increase strengths at three months from 15 to 30 percent. Indeed, one carefully selected natural sample increased strength over 10 percent when substituted for 50 percent of the cement. Anorthosite is a pure mono-mineral rock, and contains no clay or other similar substances that might weaken the concrete.

"Microscopic examination has revealed that its use causes vesicles (pores) averaging approximately 3½ percent. It thus would seem to have substantial advantages as an air-entrainment agent, without the losses of strength usually caused by materials employed for that purpose.

"Anorthosite is peculiarly resistant to changes in temperature, since it does not spall when thrown into cold water after prolonged heating under a blow torch, and the additive may contribute to the production of a similar tendency in concrete. Although no tests have yet been made in this direction, I am hopeful that anorthosite, due to its content of titanium, may increase the resistance of concrete to acids.

"Most of my experimental work has been conducted by the Raymond G. Obsorne Laboratories of Los Angeles, whose reputation in the field is no doubt known to you."

Comment by N.C.R.

It seems to be fairly well established that intermixed calcium carbonate does have some effect upon cement reaction products. It has been demonstrated by experience that the incorporation even of a percentage of limestone aggregates apparently helps prevent deleterious reaction in concrete made primarily with some kinds of siliceous aggregates. Moreover, CO is demonstrated to be a very active

reagent in many geochemical processes. We believe that both the foregoing discussions involve geochemistry—primarily colloidal in nature—which will not be understood until cement and concrete chemists and researchers approach the problem from that angle rather than from that of chemistry alone. Obviously, the ultimate objective in making concrete is to bring about, if possible, a crystallization of the cement ingredients which will have the greatest promise of permanence. To neglect to take into account certain well established concepts of colloidal and physical chemistry or geochemistry seems indefensible, if we would forward our knowledge of concrete.

What Is Concrete?

A consulting engineer of wide experience in highway construction, who did not write for publication and hence can't be named, has made some remarks, however, which are so pertinent that we do feel at liberty to quote them here in our own language. In connection with government work he had occasion to spend two years in Europe inspecting rock products operations and studying concrete. He found that the Germans made the best concrete, although he believes they could make still better. From the results of his observations he would rate the Germans first, Sweden second, France or Switzerland third, and all of them superior to us. The reason, apparently, that they achieve superior concrete, assuming the cement is the same quality, is because their methods of construction are such as to get more aggregate into it. For example, the German Autobahnen were made not only with dry mixes, but thoroughly tamped or rammed in place.

One statement our correspondent makes deserves most serious consideration. He asks: "How much longer is your magazine, which covers the rock products field, going to ignore the fact that the absolute volume of coarse aggregate in a cubic yard of concrete is not over 45 percent on the average (I have been in a position where I could determine that fact for over two years)? It should be recognized by your readers that the compressive strength of concrete comes from the coarse aggregates and that the purpose of the sand, cement and water is only to fill the voids in the coarse aggregate. Therefore, the absolute volume of the coarse aggregate per cubic yard should be in the nature of 60 to 65 percent, instead of the 45 percent now being obtained—your stone and gravel producers are losing some of this difference to sand, also to cement manufacturers who still preach 6- to 6½-bag concrete and 6 gal. of water per bag . . . To an old timer like me air-entraining is bunk."

Comment by N.C.R.

Obviously, if 15 percent or more additional coarse aggregate could be incorporated in concrete, it would have 15 percent less pore space. Few if any natural rock aggregates contain anywhere near as much pore space as do the sand-cement mortar and the hardened cement gel. We believe few people would disagree with a statement that it is primarily the water-filled pores, or capillaries if you prefer, which cause the troubles of concrete. We shall comment on this point at the end of this series of letters.

Water Removal

P. J. Freeman, who needs no introduction to readers of ROCK PRODUCTS, wrote about the "Rocky's Notes" article in the August, 1950, issue:

"I was interested in your Notes regarding sedimentation as it might apply to concrete, and I am wondering if the use of some kind of a vacuum process might not produce the kind of sedimentation which would make durable concrete.

"Several years ago a number of large concrete block were cast from which cores were drilled for testing purposes. The mixes varied from 0.8 bbl. of cement per cubic yard for the vacuum-made concrete to 1.25 bbl. for concrete placed without vacuum. Tests were made on cores taken from various depths and freezing and thawing tests indicated that the durability of the cores taken nearest the surface with a cement content of 0.8 bbl. was greater than the durability of the non-vacuumed concrete with a mix of 1.25 bbl. per cubic yard.

"In spite of the favorable results of these tests and the apparent savings which might have been made in cement, the shortage of materials and the difficulty of using the vacuum process with the construction plant as designed rendered it more desirable to use the customary process. If the increased durability of the cores may be attributed to the air pockets produced by the vacuum process perhaps the same results might be obtained by the use of air-entraining agents with less expense and effort than required for the vacuum process, but your article about sedimentation started my thoughts again about the possibility of using a vacuum for increasing durability, perhaps by methods of placing hitherto untried, which would produce sedimentation throughout the whole mass."

J. MacNail Turnball, research office, State Rivers and Water Supply Commission, Engineering Research Branch, Melbourne, Australia, wrote as follows:

"With reference to your interesting Notes on "Little Used Tools for Concrete Research" in ROCK PRODUCTS for December, 1950, page 65, I would like to draw your attention to the following publication, which I believe may already be known to you: "Growth and Movement in Portland Cement Concrete," by C. G. Lyman, 1934, Oxford University Press. This small book (139 pages) contains an excellent account of the properties of concrete, including a chapter on the hardening of portland cement with reference to the colloidal theory.

"An interesting report by the French author L'Hermite "Recherches concernant l'influence des facteurs mécaniques sur la prise des ciments et l'agglomeration des poudres minerales" (Investigation into the influence of mechanical effects on the hardening of cements and the cohesion of mineral powders) appeared in the *Proceedings* of the International Association for Testing Materials, London, 1937. Some of his results are reproduced in my paper "The Function of Water in Portland Cement Concrete" in the *Hume Pipe News*, Melbourne, November and December, 1937.

"I desire to draw your attention to L'Hermite's tests of the effect of pressure on the strength of concrete made with portland cement and powdered basalt as the colloidal binding material, respectively. Under a molding pressure of 28,400 p.s.i., the strengths at an age of 6 hours were approximately the same at 6400 lb. per sq. ft. This strength, therefore, represents that due to the molecular forces, while the portland cement, under water curing, went on to reach a compressive strength of over 18,000 p.s.i. at the age of 28 days. These tests, although beyond the reach of practical molding pressures, have always seemed to have been overlooked by later writers. This is, of course, just what you have stressed in your writings—the search for new knowledge has progressed but the results of much painstaking and fruitful research in the past have been overlooked. The need is for someone with a wide knowledge of concrete from the theoretical and practical aspects to prepare a comprehensive review of the actual state of the world's knowledge of this subject. Too much concrete research, in my opinion, has neglected the fundamental properties of the material and has only succeeded in clouding the issue.

"Some years ago, in January, 1935, I was interested in determining just how lean a concrete mix could be made. Reinforced-concrete pipe (6 spirals of 8-gauge steel wire per foot run) 12-in. internal diameter with 1⅛-in. wall were molded by the centrifugal process of the following mixtures: 1:7, 1:11, 1:20, 1:30, and 1:48 (cement:aggregate, by weight).

"The pipe were steamed overnight (low temperature steam) and were cured in water for three weeks. The interesting point is that these pipe could be handled and at the age of seven months were all subjected to

(Continued on page 94)

SCIENTIFIC USE OF LIMING MATERIALS

Value of liming, specifications for quality of agstone and government program also considered by Pennsylvania agstone producers

AGRICULTURAL LIMESTONE DIVISION of the Pennsylvania Stone Producers Association held its annual meeting at the Hotel Penn-Harris, Harrisburg, Penn., on Thursday, March 22, 1951. The meeting was well attended with 60 guests and members of the industry in attendance.

The chairman, F. Edward George, after a brief word of welcome, explained that the Pennsylvania Secretary of Agriculture, Miles Horst, would not be able to attend due to the regional meeting of the agricultural cabinet members which was being held on the same date in Boston.

Dr. A. C. Richer, Pennsylvania State College, gave a detailed discussion on the term pH as it is used in agriculture. Dr. Richer distributed a paper showing some pH values and soil and crops relationships. Using this chart as a guide, he explained that soils showing a pH of 6.5 or less are considered acid, those slightly above 6.5 as neutral, and those above 7.2 as being alkaline. He also explained what caused soils to become acid and the process by which soils were converted from an acid to an alkaline condition.

Dr. F. G. Merkle, Department of Agronomy, Pennsylvania State College, discussed the value of magnesium oxide as compared to calcium oxide in liming materials, and also the proper placement of lime in the soil. Dr. Merkle said that he had conducted many experiments in the laboratory and had a series of slides which he used to show graphically the effects the addition of calcium oxide had on plants as compared with the addition of similar amounts of magnesium oxide, based on the 1.39 formula which is currently being used in Pennsylvania.

Dr. Merkle said, "Where calcium oxide, 100 percent passing the 20-mesh sieve, containing all the fines from grinding, was added to the soil, it showed a marked effect on the plant's growth. Magnesium oxide did not show the same results, but when the top limit was reduced to minus 100 mesh, the effect on plant life approached that of calcium oxide. It was not quite as good, but almost. This was the conclusion drawn, that on the basis of correcting soil acidity, in order that the weighted value of 1.39 could be defended, MgO would have to be ground to a fineness of minus 100 mesh in order to approach the same value of a like amount of CaO ground to a fineness of minus 20 mesh."

Liming Experiments

In lime placement, the slides were equally revealing. The experiments were conducted in large buckets. In some instances, no lime was added to a neutral soil. In other cases, the top 3 in. was limed. In still other cases, the top and bottom 6 in. each were limed, and finally the soil content of the bucket was evenly limed throughout.

After the plants had grown to maturity, picture slides were made of the plant growth. These slides indicated that the leguminous plants which were germinated and grown in neutral soils would live but a few days after germination, and in some cases, if the soil was slightly acid, the seeds would not even germinate.

After these slides had been made, the roots were carefully removed and photographed. In the case where the soil was limed to a depth of 3 in., the great majority of the root structure was developed in the 3 in. which was limed, with very little root penetration below that level. In the case where the top 6 in. and the bottom 6 in. were limed, root structure developed in the top 6 in. and also in the bottom 6 in., with the growth in between being just one heavy fibrous connecting root. In the case where the bottom 6 in. was treated, there was a fibrous root down to the 6 in. level, with a fine root structure development in the area which was limed.

One interesting experiment was conducted where half of the bucket was limed with high magnesium lime and the other half with high calcium lime, equivalent amounts being added, with MgO calculated on the formula of 1.39. The divider strip, which was originally placed in the container, was removed after the pail was filled with soil. In each instance, the liming material was ground to a fineness of minus 20 mesh. In the case of the portion which was limed with MgO, the growth was considerably less than the CaO portion. Where the former was used as a liming material, there was much less fine root structure, but in the case where CaO was used, there was a great mass of roots which extended from the top to the bottom of the pail.

Dr. Merkle emphasized that the quantity of magnesium oxide used was the equivalent of calcium oxide, with magnesium evaluated on the formula of 1.39. Dr. Merkle pointed out that in these experiments, he did not give any consideration to the value which magnesium might have as a trace element, but only as a neutralizing agent to correct soil acidity.

Liming Needs

Dr. H. R. Albrecht, head, Department of Agronomy, Pennsylvania State College, addressed the meeting on the subject of the grasslands program which is being promoted by Pennsylvania State College. He opened his discussion by showing a number of slides depicting the conditions of the soils in Georgia and several other southern states as well as Pennsylvania. These slides clearly indicated the need for soil improvement in order to correct the serious top soil erosion and the building up of worn out agri-

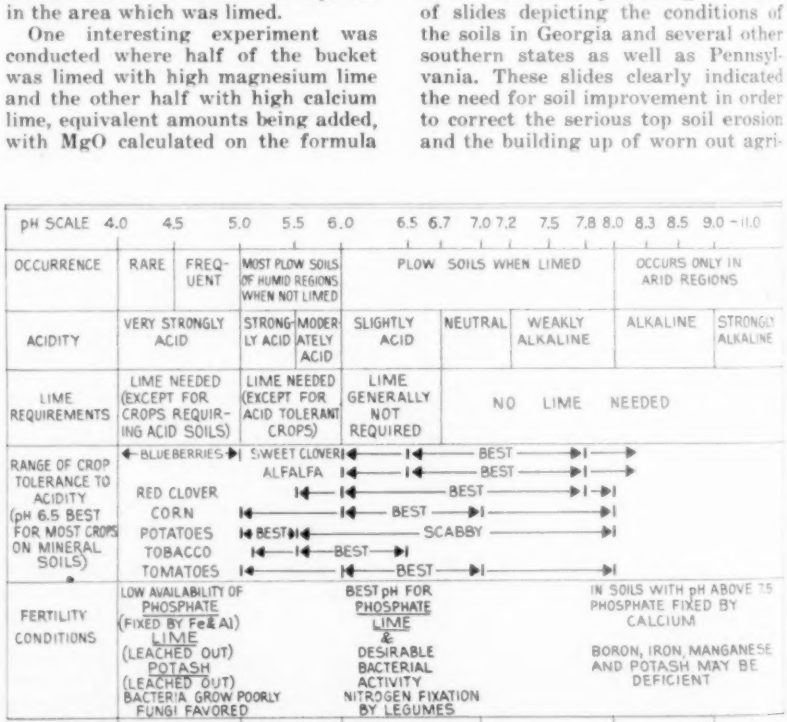


Chart showing pH values and soil and crops relationships

cultural land. He pointed out that a good grasslands program will go a long way towards correcting these conditions. He stated that this condition is serious enough to cause the United States Secretary of Agriculture to call for a voluntary ten point grasslands program throughout the United States. This program is being developed so that it will fit in with crop rotation and only convert such acreage to grassland as is best suited to that purpose, and not to the exclusion of soils that can be used to produce small grain crops.

In closing, he stressed the point that this program is very important to the agricultural limestone industry in that lime is absolutely essential in growing grasses and legumes, and that it will be most helpful if the producers and dealers are fully acquainted with the grasslands program so that they can help the state make this program successful.

Specifications

Immediately following luncheon, Robert Machmer, Bureau of Standards, Pennsylvania Department of Property & Supplies, briefly explained the new specifications as developed for the Department which will be used in requisitioning and purchasing liming material for the various commonwealth institutions throughout the state. These specifications were developed through the assistance of the Agricultural Limestone Division, Pennsylvania Stone Producers Association.

Agricultural Progress

Bruce Whitenight, representing the Pennsylvania State Committee, Production and Marketing Administration, U. S. Department of Agriculture, discussed the Agricultural Production Guides for 1951.

Mr. Whitenight also touched briefly on the Green Pastures contest which the State Production and Marketing Administration was conducting, and pointed out that they were not in conflict with the grasslands program which is being promoted by Pennsylvania State College.

Clyde Zehner, chairman of the Pennsylvania State Committee, Production and Marketing Administration, discussed the reorganization which is being effected by the U. S. Department of Agriculture in the Soil Conservation Service and the Production and Marketing Administration. In the future, these agencies will operate out of the same offices, with Production and Marketing instituting the program and the Soil Conservation Service cooperating in its fulfillment.

The open meeting was then adjourned by the chairman, F. Edward George, and a business meeting was called to order immediately.

In the absence of H. M. Binkley, treasurer, the secretary, H. H. Wagner, made the treasurer's report as well as his own report.

Officers

The following officers and board of directors were unanimously elected to serve for 1951, or until their successors are named:

Leonard S. Fry, president, Fry Coal & Stone Co., Mercersburg, Penn., chairman; D. K. Shroyer, sales manager, H. E. Millard Lime & Stone Co., Annville, Penn., vice-chairman; H. M. Binkley, Binkley Bros., Inc., East Petersburg, Penn., treasurer; and H. H. Wagner, re-elected as secretary.

Board members elected include Ivan M. Martin, Blue Ball, Penn., and Fred Roberts, Evans-Roberts, Inc., Norristown, Penn., eastern section; W. O. Faylor, president, Faylor Lime & Stone Co., Middleburg, Penn., and C. Roy Binkley (recently passed away since the meeting), Dry Run, Penn., central section; and P. E. Heim, vice-president of sales, The Carbon Limestone Co., Lowellville, Ohio, and Herschel W. Lamb, president, Grove City Limestone Co., Branchton, Penn., western section.

The new chairman, Leonard S. Fry, then appointed a program committee, with P. E. Heim as chairman, F. E. Wholaver, Whiterock Quarries, Bellefonte, Penn., K. O. Brown, New Castle Lime & Stone Co., New Castle, Penn., and Paul I. Detwiler, New Enterprise Stone & Lime Co., New Enterprise, Penn., as the other members, and instructed them to prepare an aggressive promotional program for the agricultural limestone industry by the use of slides, motion pictures and bulletins which had been released from time to time by Pennsylvania State College.

Railroad Car Supply

THE ASSOCIATION OF AMERICAN RAILROADS' Car Service Division, in response to a request from the National Sand and Gravel Association, has written a report regarding the outlook for railroad car supply in 1951, which was read at the N.S.G.A. convention at New Orleans in February.

The report stated that the national forecast of all Shippers Advisory Boards predicts a 16½ percent increase in carloadings during the first quarter of 1951 as compared with the same period of 1950, and there are indications that this estimate may prove to be too conservative. In this forecast, loadings of gravel, sand and stone are estimated to increase 6.2 percent, regardless of the announced curtailment of building activities. However, it is expected that the curtailment of building will be largely in construction of homes and other buildings rather than in the building and repair of roads.

The report continued to say that revenue carloadings have been very heavy since the first of the year, even though seriously curtailed during the strike of the railroad switchmen. In four weeks of January, approximately 3,000,000 revenue cars were loaded, representing an increase of 26 percent as compared with the same period in 1950 when coal mines were working on a 3-day week and also an increase of about 6 percent over the first four weeks of 1949.

There have been heavy shortages of practically all types of equipment since the first of the year, the greatest being box cars, which averaged about 12,000 cars per day during January, while hopper shortages averaged 3300 cars daily and gondolas 3200. In 1950 there was a reduction of approximately 16,700 hoppers and 12,000 gondolas. On the credit side, nearly 9000 hoppers and over 16,000 gondolas were restored to active service by the railroad's repair program, and on January 1, 1951, there were nearly 100,000 more freight cars on order than was true a year ago, including gains of about 18,000 hoppers and 25,000 gondolas.

In a statement issued in late December, it was announced that the railroads would continue in 1951 the billion-dollar-a-year program of expansion and improvement which has marked the last five years since the end of World War II. Last July, when railroad executives met in Chicago, they agreed upon a program of building up ownership to 1,850,000 cars by July 1, 1953, which would include 575,000 hoppers and 325,000 gondolas. This would be an increase of approximately 60,000 open top cars as compared with present ownership. Sufficient steel has been allocated to reach a monthly production rate of about 10,000 cars.

Canadian Vermiculite

SISCOE GOLD MINES expects to bring into production shortly the first commercial deposit of vermiculite to be found in Canada, according to company officials. The deposit was recently discovered in Lanark county, Ontario.

Feldspar Flotation Plant

CAROLINA MINERAL CO., Kona, N. C., recently announced plans for a feldspar flotation plant near Spruce Pine, N. C. The Spruce Pine plant is expected to be ready to begin operations about August 15, and will be about one-fourth the size of the company's plant at Kona.

The Kona plant is said to be one of the largest of its type in the world and the first full-scale plant to use the froth flotation process in producing feldspar, fine mica and iron-free quartz sand from alaskite. It is expected that the new plant will be able to process between 150 and 200 tons of alaskite per day. R. W. Lawson is president of the company.

Influence of Cement Particle Size on Strength of Concrete

A GREAT DEAL OF information has been published in technical publications over a period of time regarding strength through the fine grinding of portland cement. Fundamental data and facts of general application that provide a satisfactory explanation for the phenomena that occur, however, appear to be lacking. The postulations of Kuehl[1] are worthy of mention. He states that the strength increase of cement that occurs with increasing degree of fineness gradually stops and that the strength even is reduced. Kuehl[2], in further work, investigated the influence of uniform and mixed sizes of cement particles in regard to their strength properties and came to the following conclusions:

1. A cement developing the inherent strength properties attainable from given raw materials can be produced with greater economy if a uniform particle size of about 30 μ is produced, rather than if there is a range in particle size variations present and associated in a non-uniform and irrational particle component system.

2. By having greater fineness of the particle sizes, down to about 15-20 μ, it is possible to develop very considerably the strength properties of such a cement with uniform particle size in a quite economic manner.

3. By adding a very coarse fraction as an admixture, an extremely finely ground cement can not only be improved in regard to the economic efficiency of its production, but with regard to the absolute maximum of its hardening strength.

Helbig[3] has also reported the results of prolonged research and has concluded that the fine grinding of cement is only limited by economics, and that the finer the cement is ground, the higher will be the strengths that are achieved. Regarding the influence of the particle-size distribution of a cement on its strength properties, Eiger[4] and Guye[5] have stated that the higher strength value is not to be attained by a large fraction of the finest grain sizes (down to 5 μ) but can be achieved by a large fraction of the medium particle sizes (10-15 μ and 30-40 μ). The conclusions of Guye, that the finest particles below 5μ which hydrolyse very quickly in mortar and concrete are of secondary importance to the hardening of the cement, are interesting in this connection.

This may be considered rather as a filling medium rather than as a bonding agent. On the other hand, the particles above 60 μ in size also play a significant role in the hardening because of their slow rate of hydration. Helbig[6] has stated that it is always the lighter-burned clinker which is present in the finest particle fraction and that, consequently, with particle size fractions below 10 μ, the strength properties are influenced unfavorably.

Kavcic[7] also has stated that the crushing strength after 28 to 60 days increases all the more—the less a cement contains of the fraction below 10 μ. Finally, in an unpublished communication, Kuehl states that the finest fraction, with a diameter of less than 1 μ, obviously has no appreciable significance on the hardening capacity of a cement. The reason is that the hardening process must be so conceived that the individual cement particle is first surrounded with a gel coating by surface hydration, and that this then becomes impoverished in water with the further progress of the hydration to the interior of the cement particle, and consequently sets (internal absorption). The course of this process requires, however, a certain particle size, because if the particle is too small it is rapidly converted, right to its core, into a gel-mass and this can then no longer undergo a setting process, because of the absence of the internal absorption effect.

This internal absorption has been investigated in detail by Anderegg and Hubbell[8]. The research served to establish that the hydration, after 24 hr., had attained a depth of 0.5 μ, after 7 days of 1.7 μ, and after 27 days of 3.5 μ.

Research on the Problem

Influence of fineness of grinding and the hardening time of various portland cements on their strength properties has been the subject of cooperative research by the cement manufacturers association. As a result of this research, it was found possible to clarify quite clearly the process of bonding and hardening in relation to the particle size.

The research was conducted during 1944 and 1945, in the laboratories of the Mining Institute, Freiberg, Saxony, simultaneous research being conducted on a Silesian and a purchased cement. First, fractions of various particle sizes were prepared and their specific surfaces were ascertained. Test samples were then prepared from each fraction, according to normal standard test methods used by the cement industry, and the bend strength and crushing strength were determined after hydration times of 2, 7, 28, 56 and 112 days.

The following test samples were prepared and examined:

I. Test series: *Silesian portland cement*

A = 20.2 }
B = 16.4 }
C = 8.6 } percent residue on a sieve of 0.008 mm. opening obtained by grinding
D = 6.6 } in a laboratory ball mill.
E = 2.1 }
F = 0.2 }

G = —60 μ obtained by sizing a finely ground sample

H = —50 μ }
I = —40 μ }
K = —30 μ } produced by air classification
L = —20 μ }

II. Test series: *Purchased commercial cement*

NA = conditions as delivered
NB = less than 60 μ produced from NA by sieving
NC = minus 40 μ } produced from NA
ND = minus 20 μ } by air classification

III. Test series: *Purchased commercial cement*

NE = produced from 50 percent ND + 50 percent NA
NF = produced from 80 percent ND + 20 percent NA

Test Details

Grinding of cement clinker samples. First, about 3 kg. of Silesian clinker from each sample was coarsely crushed by crushing rolls (roll opening 5-6 mm.) and then further ground in a laboratory ball mill. After about 14 hr., the limits of grindability had been reached, i.e., particle size coarsening began to be produced again in the mill material.

It is known also that materials also can only be finely ground in hammermills down to a certain limit. Gruender and Stuckman[9] found, for example, that the limit of grinding of coal was reached after 25 hr. in a swing-hammermill. (See also Gille, "Grinding of cement clinker in swing hammermills."[10])

Translated and reviewed by B. M. Pearson from W. Gruender (Belgrade) and S. Tabbah (Damascus), *Zement-Kalk-Gips*, vol. 4, no. 3, pages 67-71.

Determination of the particle sizes. The cement fineness was first ascertained by a sieving analysis and this was conducted with test sieves of 150, 120 and 88 μ openings. To proceed further into the area of the finest particle size, the finest standard sieve, of 60 μ mesh, was used as well as non-standard meshes of 40 and 28 μ respectively. Since available particle size curves end at 60 μ, but the finest grain size fraction nevertheless is by far the greatest part, the particle size fineness in the finest grain-size region must also be determined. Accordingly, sediment analyses were conducted by the pipette method of Andreasen[11]. As liquid for this study, 99 percent ethyl alcohol with 3.3 gm. of $CaCl_2$ per liter was shown to be satisfactory.

Because of its low density (0.796 gm./c.c. at 18 deg. C.) and its low viscosity (0.0167 poise at 18 deg. C.), with a sedimentation time of 2 min. in the pipette apparatus, it is only possible to fix a coarser cement particle of 47.3 μ. Thus, with sediment analysis, the finality of the sieving analysis is not quite attained. As it was necessary to prepare particle fractions below 60 μ, simultaneous particle size determinations were made by the air classifier by Gonell's method[12]. The results of the particle size determinations of a fraction by these three methods of examination are presented in Fig. 1 in the form of graphical grain size curves. It will be seen from the diagram that the air-classification analysis by Gonell's method is in good agreement with the results from the sieving analysis, while the results of the sediment analysis have only given usable values down to about 25 μ.

Preparation of the test body. The material for the first series of tests (Tests A to F) was prepared by sieving a finely ground Silesian cement clinker and the clinker was first ground to a residue of 20 percent on the standard sieve of 88 μ opening. After the addition of 3 percent of gypsum (semi-hydrate $2CaSO_4 \cdot H_2O$), the mixture was further finely ground for the preparation of samples with decreasing residues. Usually, gypsum is added to the cement clinker before grinding but, in this case, because of the relative softness of the gypsum, this would have caused a concentration of this material in the finest fractions and would have reduced the strength values.

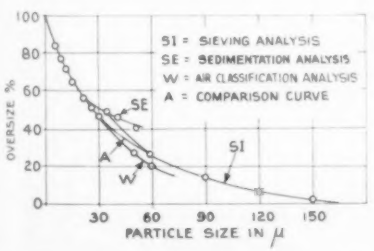


Fig. 1: Particle size curves of cement NA by sieving and sedimentation analysis as well as by air classification

The fractions H-L were fractionated by sieving. The first series of tests should clarify the influence of the specific surface and the time of storing on the strength of the Silesian portland cement. The second series of tests with the purchased cement served for study of the influence of the individual and mixed size cement particles on their strength properties. The samples above 60 μ were prepared by sieving and those below 40 μ and 20 μ respectively, were obtained by air classification. A third series of tests should serve to show further the influence on the strength properties of the concentration of the finest particles in a commercial cement by varying large additions of a fraction of maximum fineness.

It is only possible to fractionate small test samples of 10-12 gm. in Gonell's air classification apparatus. For the preparation of sufficient fractions of at least 1 kg., it is necessary to modify this air classification apparatus so that the amount produced per test will amount to around 500 gm. A larger form of this apparatus was first made from celluloid (Fig. 2) of the same shape as the original apparatus, so that a satisfactory circulatory motion is given to the material. The diameter of this modified equipment, 7 cm., corresponds approximately to the diameter of the average tube.

The differential pressure measuring apparatus was filled, in this modified apparatus, with a heavy liquid of specific gravity 2.84 (mixture of bromoform and carbon tetrachloride), and the standardization was conducted with the aid of a gas-clock.

For the calculation of the necessary amount of air for the preparation of a definite particle fraction, the following equation is used:

$$V = v\,H\,r^2$$

in which V is the necessary amount of air in c.c.

v is the air velocity in cm./sec.

r is the radius of the tube in cm.

The necessary air velocities can be calculated in approximation with Stoke's law, in which the specific gravity of the cement, as determined by means of a vacuum pyncnometer, was taken as 3.1 and for the air as 198 x 10^{-6} gm./cm./sec.

The following air blast velocities were calculated for the preparation of the required fractions:

for 20 μ..... 3,413 cm./sec.
for 30 μ..... 7,681 cm./sec.
for 40 μ.....13,652 cm./sec.
for 50 μ.....21,334 cm./sec.

The requirement for satisfactory air classification is a sufficient dispersion of the material being classified in the apparatus and the avoidance of turbulence currents in the glass cylinder. The first condition was fulfilled by the classification effect obtained,

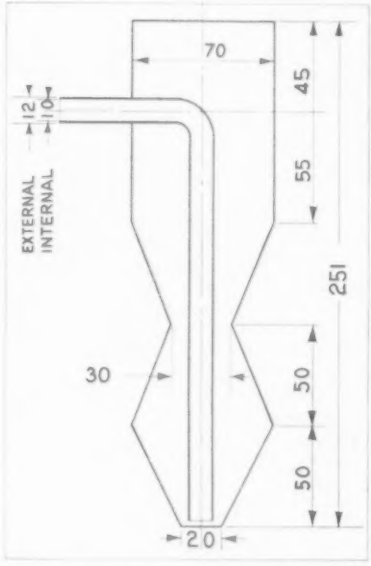


Fig. 2: Celluloid apparatus for the Gonell air classification test. Dimensions are in millimeters

and the calculation of the Reynold's figure showed that lamination was present in the classification tube, even with the maximum air blast velocity.

Strength Tests

The test bodies were prepared according to DIN 1164 (German Standard). A saturated solution of gypsum was used instead of water, in order to prevent rapid bonding of the fractions below 40 μ. When making up the cement-sand mixture with water, the following observations were made:

1. With a fine-grained cement, below 40-50 μ, as a result of the large specific surface, an intensive reaction occurred between the make-up water and the cement. This reaction led to the formation of nodules, which made hand mixing difficult and the nodules could only be removed by a mortar mixer.

2. The normally ground cement and the remaining coarse cement fractions formed a soft cement slip with the make-up water which was somewhat difficult to stamp in the molds. As a result, the pores of the cement-sand mixture remained filled with water before the bonding. Because of the internal absorption a more or less porous test body remained after hardening.

The bend strength and crushing strength on these test bodies were ascertained after water standing periods of 3, 7, 28, 56 and 112 days.

Test Results

On the basis of the sieving, sediment or air classification analyses of the particle sizes of the individual samples, the particle size curves were first developed. The designation of the particle fineness as the residue on a

4900-mesh sieve is unsatisfactory as with postulation, no determination of the fineness of a cement can be made. If it is desired to compare the particle fineness with the strength properties, it is necessary to express the particle size fineness as far as possible by a single numeral. It consequently seemed more practical to regard the specific surface as a standard for the particle size. Consequently, for each fraction, particle size curves not only were determined, but also the specific surface.

At present, the greatest difficulties are presented in arriving at an exact determination of the specific surface. It can be undertaken experimentally, by calculation or by graphical means. Mention should be made here of the comprehensive and fundamental work of Rammler[14] on the determination of the specific surfaces of ground materials, and also of the work of Haegermann[15] and Kuehl[16]. The differences in ascertaining specific surface by methods specified in the literature, are great. For example, the specific surface of the cement sample NA was determined according to these various methods. The following picture was then obtained:

According to Haegermann, with his modified formula used by the Belgian cement industry—1381 sq. cm./gm.

According to Rammler, determined graphically—6387 sq. cm./gm.

According to the exponential law of Rosin—2730 sq. cm./gm.

According to Kuehl (approximation formula)—1272 sq. cm./gm.

It would take too much space to discuss in detail these surface determination methods and the calculation methods. The objective of the present work is concentrated merely on the question of the influence of the fineness of the particle size on the strength properties. It is therefore a question more of ascertaining comparative, relative surface figures than of ascertaining absolute values.

In order to show the findings regarding the specific surface figures of the individual samples, the graphical method for the determination of the specific surfaces was chosen for all the samples of the three series of tests. In addition, the specific surfaces of all samples of the test series II and III were calculated according to the approximation formula of Kuehl. This was done in order to be able to make a comparison with the results of the investigations undertaken by Kuehl on the influence of individual particle sizes on the strength, with the author's investigations on the influence of mixed particle size fractions.

The experimental results obtained are shown in Table I. In columns 2-6 are given the bend strength values. Columns 6 and 11, which show the strengths of the samples after a hardening time of 112 days, are incomplete because of interruptions due to the war. In column 12, the specific surface is rendered as the relative amount and in column 13 as the value coefficient. This value coefficient should represent a direct expression of the loading value of a cement. It was used for the first time by Kuehl[2] in cement technology for the evaluation of his research results and was obtained by the addition of all crushing strength values with ten times the bend strength value. The value coef.l-cients of the first series of tests comprise the four samples with storage times of 3, 7, 28 and 56 days; those of the second and third series of tests, on the other hand, were for samples with 3 and 7 days hardening duration. In order to be able to draw a comparison between the results of the present research and those of Kuehl[2], these are also included in the table.

Here, the value coefficients are doubled, because Kuehl, in his research, prepared the test bodies and tested for strength according to his small scale test process[17]. Column 14, designated with η, represents the quotient from the value coefficient and the specific surface. If the specific surface of a ground cement is considered as a loading value induced by the grinding process and the value coefficient as the effective loading value given by the cement, then the quotient η, from the value coefficient and the specific surface, represents the degree of efficiency of the cement. F_m is the average value of the strength figures of all fractions from the first series of tests.

If the influence of the water storage time on the strength properties of the cement is considered, then the conclusion can be drawn that the fineness of the cement has no influence on the extent of the final bend strength but has a very strong influence on the initial bend strength for periods up to 7 days. Also, with the crushing strength, the initial strength rises quickly with increasing fineness of grinding.

If the value coefficient, the load value of a cement, is used in a coordinate system plotted in relation to the specific surface (Fig. 3), then a steeply rising curve is obtained. The loading, i.e., the strength value of a cement, is very greatly dependent upon its specific surface and particularly in the region of smalll specific

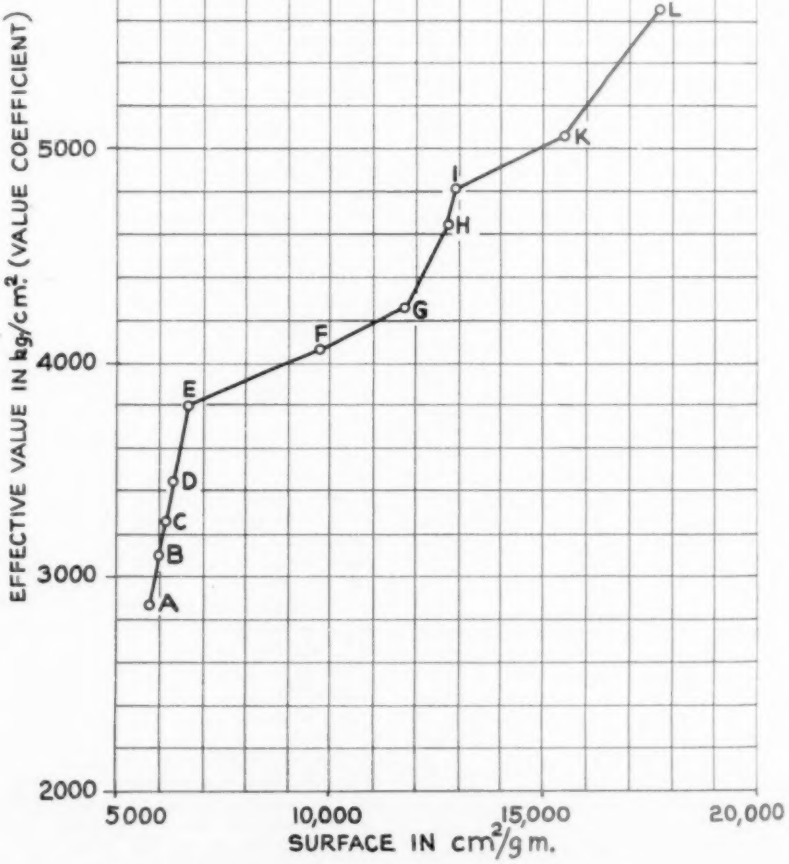


Fig. 3: Effective value figure in relation to surface factor

surfaces. By extrapolation of the curves, according to their tendency, it can be assumed that an optimum value will result when a certain specific surface is reached, which will correspond to the maximum strength values which are possible with a portland cement of a definite chemical composition.

When column 14 of Table I is considered, it can be seen that cement E with a residue of 2.1 percent on a test sieve of 88 μ opening gives the best degree of efficiency, 56.8 percent; such a cement is the most economical to produce. Since the strength values obtained from such a cement are still much too small, it is sought to increase these values but naturally at the expense of the operational efficiency.

With a mixed particle size (third series of tests) the rise in the value coefficient is much steeper than with a uniform particle size. Higher strength values can be obtained from a cement with a mixed particle size than with a uniform particle size and, in fact, in the region in which the specific surface exceeds 1200 sq. cm./gm.

In the second series of tests (II), the test sample NC 93.5 (see Table I, column 14) shows the best coefficient value. This sample NC consists of a particle classification of 0-40 μ. It shows the comparison with sample I of the first series of tests, which likewise consists of a particle classification of 0-40 μ, a much higher value coefficient. This is based apparently on the differences in the chemical composition of the Silesian cement clinker and the purchased commercial cement. This difference in the chemical composition can also be recognized in the differences in the strength values.

Conclusions from Experiments

It is possible to draw the following conclusions from the experimental results.

1. The strength properties of a cement initially increase rapidly with increasing time of water storage and then remain constant. In order to prove this, mention can be made of the following numerical example. With cement A, the bend strength after 3-7 days storage had increased from 25 to 36 kg./sq. cm., thus by 44 percent and, after from 28 to 56 days, had increased from 46 to 55 kg./sq. cm., which is only by 5.1 percent. The crushing strength had increased by 57 percent after from 3 to 7 days and only by 7.7 percent after from 28 to 56 days storage.

2. The initial bend strength rises very rapidly with increasing specific surface. The bend strength after three days storage increases from the normally ground cement A (25 kg./sq. cm.) up to the cement L (53 kg./sq. cm.) which is by 112 percent, while, after 56 days storage, this increase of 55 up to 95 kg./sq. cm. only amounted to 72 percent.

3. The bend strength thus obtains its optimum value at an earlier date, the more finely the material is ground. The finely ground cement L, undergoing from 3 to 56 days storage, shows an increase in the bend strength value of only 79 percent. On the other hand, the normally ground cement A undergoes an increase of its bend strength value of 120 percent over the same period.

4. The crushing strength rises with increasing fineness and requires a long storage time until its optimum value has been attained.

5. By the addition of a finest particle fraction to a normally ground cement, no strength increase was obtained. A cement consisting of 80 percent minus 20 μ particles and 20 percent of normally ground commercial cement gave smaller strength values than did the 100 percent cement minus 20 μ.

6. With the hydration of the cement, a gelatinous envelope is formed, which hardens during the course of time. The hardening of this gelatinous envelope is based on "internal absorption" which leads finally to complete hydration of the cement, by which the cement attains the optimum strength value.

7. The fine grinding has no influence on the amount of the optimum value; on the other hand, it influences the initial strength value considerably and renders this closer to the optimum value (final strength).

If column 14 of Table I is considered, it can be seen that the cement used in the first series of tests (I), with the designation E, has the highest degree of efficiency with $\eta = 56.8$ and, in consequence of this, shows the best strength properties. Since the strength properties of such a cement are always not quite sufficient, an endeavor is accordingly made to improve these properties by further fine grinding at the sacrifice of economy. However, practical working economies set a limit to the degree of fine grinding imposed, which apparently will be located around the point 1 in the diagram. This means that a further fine grinding of down to 40 will be permissible, by which the working efficiency will recede to 38.3. In addition, the same ND of the second series of tests (II), which consists of a particle size classification of 0-40 μ shows the best degree of efficiency of 93.5. The sample KD of the investigations by Kuehl, which consists of a

	BEND STRENGTH IN kg/sq. cm.					CRUSHING STRENGTH IN kg/sq. cm.					SPECIFIC SURFACE O IN cm^2/g m.	EFFECTIVE VALUE W_e IN kg/cm^2 (VALUE COEFFICIENT)	$\eta = \frac{W_e}{\sigma}$ (DEGREE OF EFFICIENCY)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	DAYS WATER STORAGE												
	3	7	28	56	112	3	7	28	56	112			
I. FIRST SERIES OF TESTS													
A	25	36	46	55	63	175	275	390	420	520	5960	2880	48.5
B	25	35	52	58	62	210	326	412	485	542	6010	3133	52.0
C	26	39	53	60	65	231	340	434	460	510	6060	3245	53.5
D	27	44	56	64	66	220	335	440	560	530	6260	3465	55.2
E	32	53	59	70	75	254	341	456	570	650	6630	3761	56.8
F	43	57	61	72	76	282	417	478	535	650	9870	4058	41.0
G	46	57	65	76	81	326	435	510	570	660	11,590	4281	38.0
H	49	61	72	76		348	485	370	680		12,500	4663	38.3
I	47	70	72	82		360	550	580	615		12,920	4815	38.3
K	49	73	73	84		360	550	615	752		15,430	5067	32.8
L	53	79	92	95		380	445	766	880		17,680	5661	32.0
F_m	38	55	63	71		286	427	514	593				
II. SECOND SERIES OF TESTS													
NA	24	37				225	315				1272	1150	90.0
NB	30	44				275	320				1480	1335	90.0
NC	40	52				320	368				1720	1608	93.5
ND	53	66				385	490				2360	2065	87.5
III. THIRD SERIES OF TESTS													
NE	25	46				218	340				1816	1268	70.0
NF	40	65				310	463				2142	1823	85.0
RESEARCH RESULTS OF KUEHL [SEE ZEMENT, VOL. 19, PAGE 604 (1930)]													
KA	ORIGINAL CEMENT										1050	874	83.5
KB	50 - 60 μ										352	236	67.0
KC	40 - 50 μ										430	316	73.6
KD	30 - 40 μ										555	708	127.6
KE	10 - 20 μ										1290	1224	95.0
KF	<10 μ										3225	1370	42.4
KG	35%-10 μ	65% 50-60 μ									1358	852	62.8
KH	80%-10 μ	20% 50-60 μ									2650	1426	56.8

Table I. Experimental results

uniform particle size classification of 30-40 μ, likewise shows the best degree of efficiency of 127.6. From this finding it can be accepted that a mixed cement particle size of below 40 μ and a uniform cement grain size fraction of 30-40 μ provides the best strength properties with regard to economic efficiency of the cement production process.

As the cement with a mixed particle size is able to be more efficiently produced than one with a uniform grain size, because the separation of the finer particles becomes more difficult and it is difficult to find a market for the rejected fraction, quite obviously, only cement with a mixed particle size can be produced.

Accordingly, the application of swing hammermills will be the most desirable means for grinding. If an air classifier is coupled to the swing hammermills, then the formation of cement particles smaller than 1-5 μ, which according to Kuehl and other research workers reduce the strength properties, can be avoided.

As preliminary research for this work, there was first determined the grinding limits of a Silesian portland cement clinker in a laboratory ball mill and the most suitable liquid found for the particle fineness determination, to be used as the suspension medium for the pipette process of Andreasen. The limits of grinding were reached with a grinding time of 14 hr. Absolute alcohol has given best service as the measuring medium for the particle fineness determination. After this, cement samples were first prepared by grinding, sieving and air classifying a Silesian portland cement clinker and a purchased commercial cement with the addition of 3 percent of gypsum. For the preparation of particle fractions below 60 μ, a Gonell air classifier was modified.

For testing of bend strength and crushing strength, test bodies were prepared according to German Standard DIN 1164, stored for 3-112 days under water, and tested for strength according to German Standard DIN 1164.

The specific surface of the purchased commercial cement was ascertained by four different procedures, which gave considerable deviation. For the evaluation of the test results, the specific surface was ascertained by the graphical process of Rammler. In addition, the specific surface of the purchased commercial cement and of the fractions separated from this were determined by the approximation formula of Kuehl in order to be able to compare the results of the present investigation with mixed particle size fraction cements, with those of Kuehl with a uniform particle size.

From this work, the following conclusions can be drawn:

When the cement is made up with water, there is formed a gel envelope, which progressively hardens with time up to complete hydration, by which process the optimum strength value is obtained.

Fine grinding has no influence on the amount of this optimum value but, on the other hand, it influences the initial strength.

The strength properties rapidly increase in the beginning, and then, subsequently, slowly reach the optimum value.

The initial bend strength increases very quickly with increasing specific surface.

The bend strength reaches its optimum value earlier, the finer the cement is ground.

The crushing strength rises markedly with increasing fineness, and requires a much longer storage time to enable it to reach its optimum value.

With the addition of a fraction of maximum fineness to a normally ground cement, no increase in strength value is obtained.

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Agricultural Appropriations

AGRICULTURAL LIMESTONE INSTITUTE, in a letter to member companies, has reported on the recent status of agricultural appropriations. The House Subcommittee on agricultural appropriations recently concluded its hearings on the bill which will appropriate money for the operation of the U. S. Department of Agriculture for the fiscal year ending June 30, 1952. The industry has expressed its concern because of recent attempts by some groups to reduce expenditures for the Agricultural Conservation Program. The American Farm Bureau Federation, representing about 1,500,000 farm families, has publicly declared that it will ask for a reduction of $135,000,000 in A.C.P. funds for the 1952 program, which, in the opinion of the Institute and the industry, would have serious effects on the conservation of the nation's soils.

At the sixth annual convention of A.L.I., held in Cincinnati, Ohio, February 7-9, a resolution was adopted instructing the A.L.I. staff to prepare a statement of the association's position with respect to the need for the continuance of the program and to submit it to the proper congressional committee. The statement was submitted March 7.

A.L.I. also announced that it had inquired into the position of the A.F.B.F. by personally discussing the matter with Roger Fleming, A.F.B.F.'s Washington representative. Mr. Fleming stated that the Board of Directors of A.F.B.F. is very seriously concerned about the future of America, and as he and other A.F.B.F. members see it, policies which are rapidly leading the American people down the road to inflation must be stopped and the integrity of the dollar must be preserved. One of their recommendations to Congress is that *all* non-defense appropriations be cut 20 percent and the funds for the 1952 conservation practice be cut from $285,000,000 to $150,000,000. They also are recommending tighter credit controls and a reversal of the Treasury's "easy money" policy. This obviously would be a setback to the continued maintenance and increased productivity of the soil.

North Carolina Wants a Cement Plant

A 5-MEMBER STUDY COMMISSION, in a recent report made to Governor Scott and the General Assembly, recommended that a portland cement plant should be built in North Carolina—preferably by private capital, but by the state if necessary.

The commission said the most likely source of suitable raw materials is in eastern North Carolina; field exploration has uncovered a source of marl suitable in quality and adequate in quantity for the establishment of an average-size portland cement plant, with a capacity of about 1,000,000 bbl. of cement per year.

The commission further stated that a state agency should attempt to persuade private capital in North Carolina to build a plant, or failing this, private capital outside the state. But in the event of failure of either or both of these sources of capital within a reasonable time, then it was recommended that the State of North Carolina proceed immediately to construct and operate one or more cement plants for the purpose of producing portland cement for the various state agencies.

To Double Capacity

SPOKANE PORTLAND CEMENT CO., Spokane, Wash., plans to spend $3,500,000 in the next few months to double its plant capacity. The project will be started as soon as the company obtains a certificate of necessity from the National Security Resources Board. With completion of the project the plant will have a rated capacity of 1,300,000 bbl. per year.

Cement Comments

(Continued from page 85)

an internal hydrostatic pressure of from 25 to 5 p.s.i. The two leanest mixtures were only taken up to 5 p.s.i. for 5 minutes and, naturally, were not watertight, but did not 'collapse.' All the pipe were later tested under external loading by the three-edge bearing method. The mixtures were designed as routine problems, without any trials, and included aggregate up to ¾-in. maximum size. The results of L'Hermite's tests, consequently, were not entirely unexpected.

"Again permit me to express my appreciation of your thought provoking articles."

Bleeding of Cement Pastes

T. C. Powers, manager of basic research, Portland Cement Association, takes exception to some of our comments on his studies of water in portland cement pastes, based on the review of his research paper, Bulletin 22 of the P.C.A. He writes:

"The appearance of this article ('Directing and Using Research,' January, 1951) by Mr. Rockwood is a very gratifying development. It is encouraging indeed to see the results of our work being given serious attention in a manner that is likely to encourage others to explore its possibilities also.

"The research work to which Mr. Rockwood referred and the published papers that have resulted from it represent more than twelve years of effort. It is not surprising therefore that certain misunderstandings should arise from a limited study of this voluminous and somewhat complex work.

"For example, on page 126 (of ROCK PRODUCTS) under the heading 'Is This True?' Mr. Rockwood quotes our statement, 'If all such water is driven from the paste, the cohesion of the paste is destroyed.' Mr. Rockwood evidently mistook this statement as one being based on theory or inference and thus felt it proper to question the statement on the basis of his own counter theory. However, the statement is not one of theory or speculation; it is merely one of fact. When the hydrated cement is raised to sufficiently high temperature, all the water is driven off and the remaining solids are practically devoid of cohesion. It is a matter of routine for us to observe this phenomenon. Almost every day we heat small disks of cement paste to 1000 deg. C. Before heating, each disk can withstand a compressive force of the order of 15,000 p.s.i. After heating and cooling the disk may easily be crushed between the fingers.

"A considerable part of what Mr. Rockwood has written concerning the chemistry of portland cement in this and previous articles appears to be based on the belief that water is not an essential part of the solids in hardened cement paste. However, the fact is that some water becomes an integral part of the solid material that results from the hydration of cement. This material in some ways resembles silica gel but it also differs from it in very important ways.

"Mr. Rockwood departs from our nomenclature in discussing the different classes of water when he classes gel water as non-evaporable water (bottom of first column, page 126). Moreover, our articles somehow failed to make it clear that the gel water and the non-evaporable water are characteristics of the solids formed by the hydration of the cement. We did not mean to convey any impression of approval or disapproval of these classes of water. We merely described what we found. Had we been describing blue vitriol we would have mentioned that it is copper sulfate containing 5 molecules of water of crystallization. In describing hydrated cement paste we mentioned that it contained a class of combined water called non-evaporable water and another class that was evaporable, a subdivision of which we called gel water. These two classes of water, non-evaporable and gel water, are as characteristic of hydrated cement as the 5 molecules of water are characteristic of blue vitriol.

"Some of the specimens that were studied had been molded under pressures up to 30,000 p.s.i. and contained as little as 6 percent water by weight of the cement. The characteristics of the gel found in these samples were the same as those found in samples having higher water contents molded in the usual way. Hence, Mr. Rockwood's speculations as to the desirability or undesirability of gel water or non-evaporable water seem somewhat academic. As long as we are dealing with portland cement paste cured at normal temperatures, we must deal with these classes of water as we find them.

"Mr. Rockwood says that my earlier writings gave the impression that I considered the loss of water from fresh cement paste by the process of bleeding to be undesirable. Possibly others have drawn the same inferences. At any rate I should like to correct that impression. Our rather extensive studies of the process of bleeding have not led me to believe that the loss of water from the paste through bleeding is detrimental to the paste. Indeed, like Mr. Rockwood and others, I believe that any factor that reduces the water content of the paste before it hardens is beneficial to the paste. However, it is a fact that a change benefiting the paste is not necessarily one that benefits the concrete as a whole; at least it will not benefit all of the important properties of the concrete. For example, if a concrete mix has such characteristics that it bleeds rapidly, the addition of a mineral powder will reduce the amount and rate of bleeding and, though chemically inert, will increase the compressive strength and reduce the permeability, the latter effect being by far the more important. However, the paste itself is weaker than it would have been had the amount of bleeding not been reduced.

"I surmise that most concrete technicians understand this phenomenon. The effect is produced simply by stiffening the paste, reducing its bleeding capacity, and thereby minimizing the formation of fissures at the undersides of the aggregate particles. The paste is weakened (slightly) but the concrete as a whole is strengthened and made more watertight.

"In 1939 I along with others thought we had evidence that excessive bleeding was associated with low frost resistance. As the experimental work progressed I became convinced that we had been misled. Actually a reduction in bleeding by the device described in the preceding paragraphs increases the rate of disintegration of specimens in the freezing and thawing test. We now understand how this comes about, in terms of the hydraulic-pressure hypothesis.

"In 1945 my view on the relative importance of the phenomenon of bleeding was expressed in the preface to PCA Bulletin 4 as follows: 'On the basis of these studies the writer is now inclined toward the view that if any steps at all are required for the control of the bleeding characteristics of a given cement they should be confined to a regulation of the specific surface of the cement or perhaps to the addition of air-entraining or gas-forming agents; however, neither a change in specific surface nor any addition should be made without careful study of the effects of all the important properties of concrete. With respect to other factors that influence the bleeding characteristics it now seems that differences in bleeding characteristics among cements of similar specific surface are not fundamentally of great importance; they are decidedly secondary to other properties that the manufacturer must control.'

"Mr. Rockwood's suggestion for draining the water from fresh concrete by means of embedded pipe indicates that he has never tried the process. I suggest that he deposit a quantity of fresh concrete on top of a sheet of metal lath or a sieve and measure the quantity of water that he is able to obtain in this manner. One of the virtues of the type of research reported in PCA bulletin 2, to which Mr. Rockwood refers, is that it enables us to predict the result of such an experiment before making it.

"We think that Mr. Rockwood is doing a commendable service in calling attention to the need for fundamental approaches in concrete research. May he continue to do so."

Comments by N.C.R.

Of course, we or anyone else would have to agree with Mr. Powers that when water actually combined with a mineral in crystal form is removed by heat or otherwise, the crystal will

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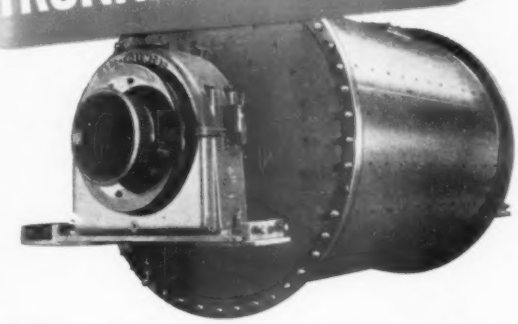
TRUNNION BEARING



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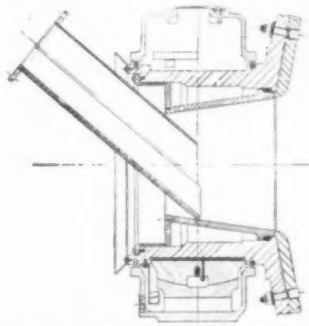

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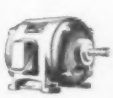

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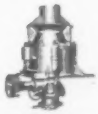


Crushers

Kilns, Coolers, Dryers

disintegrate. However, we understood, possibly wrongly, that his researches have shown that there is no proof of chemically combined water other than in the calcium hydroxide and the calcium sulfoaluminate. The rest appeared to be capillary water and gel water—in other words it was still water although the gel water was described as condensed or compressed to 0.8 of its normal volume.

Our argument was *not* that *no* water was essential, but that any *free* water—water that was not chemically combined—must be detrimental. We can readily understand why tiny cement paste disks would disintegrate after being heated to 1000 deg. C. and cooled in air. That would recalcine the $Ca(OH)_2$, but a very short exposure of such a small, thin specimen to laboratory air or to the moisture of one's fingers would rehydrate the lime ("air-slake" it, at least) and the subsequent expansion would disintegrate the disk. It is probable that the interior of a concrete block or wall does not reach that temperature in a fire test, but such a temperature as it does reach must be sufficient to drive off even the chemically combined water. We do not believe concrete disintegrates under such conditions. We hope not, or less concrete will be used for fire walls.

Perhaps our views on this whole subject are best expressed in the accompanying notes, which summarize a discussion of a paper read at the recent annual meeting of the Indiana Mineral Aggregates Association, by S. W. Benham, of the Indiana State Highway Department. He submitted incontestable proof that on a trunk line pavement after 11 years' service, a portland cement blended with 15 percent natural cement made a markedly more durable concrete than that on a parallel pavement on the other lane of the same highway, made with the very same portland cement and aggregates, without a blend of natural cement. Both had identical subsoil and traffic conditions. Laboratory tests on pavement cores showed definitely that while the blended cement concrete apparently remained about 15 percent below the straight portland cement concrete in compressive strength, it was nevertheless tougher or more resilient under repeated loading tests. In discussing this paper, by request, we said:

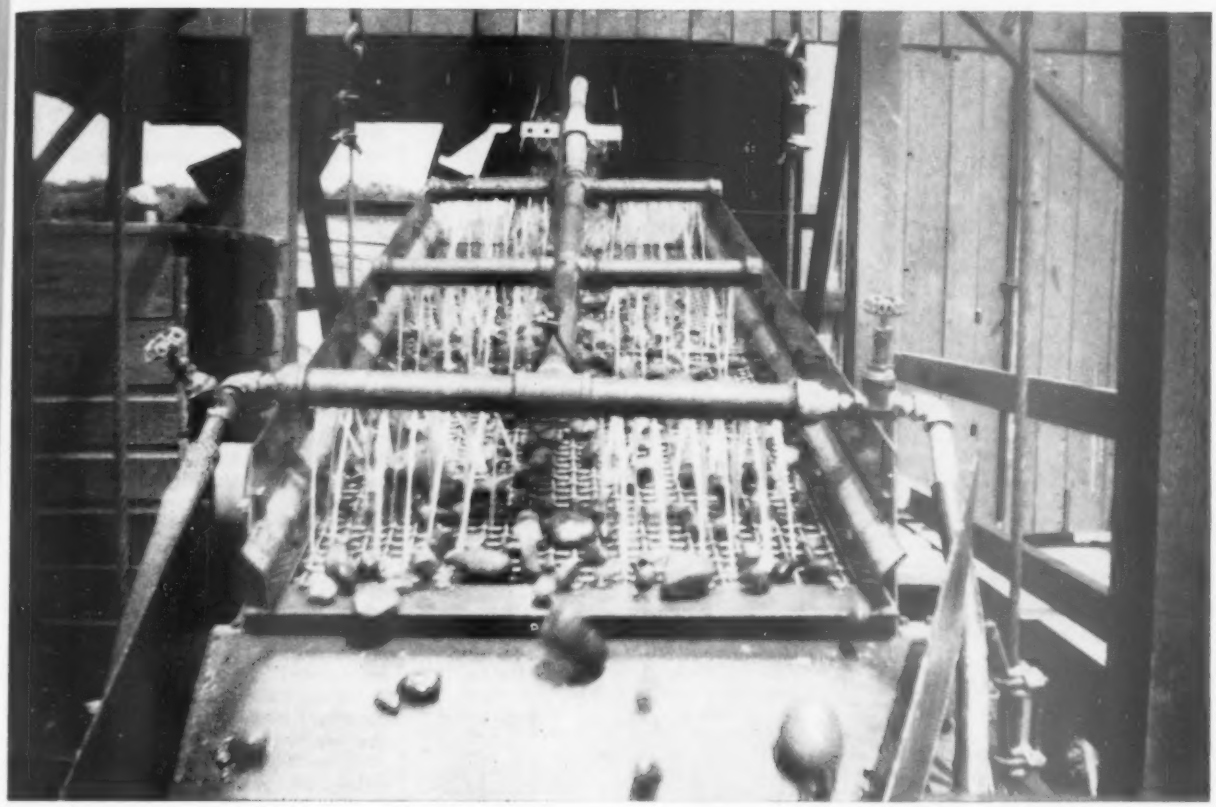
Blended Cements

"The chief interest in this paper we have just heard, to some of us, is the addition to the fast accumulating evidence that modern portland cements *may be improved*, at least for making more durable concrete pavements.

"That statement may seem gratuitous, but bear in mind that some portland cement manufacturers or their technical representatives have taken a position that present-day portland cements are nearly perfect, and that concrete failures are caused not

"Paid For Itself On One Job!"

Says Syracuse Sand & Gravel Co., Inc., of This Seco Vibrating Screen



***More Proof* for Top Tonnages and Smooth, Trouble Free Operation . . . You're Ahead with a Seco**

About a year ago, the 3½ deck Seco pictured above was put into operation at the Nedrow, New York plant of the Syracuse Sand and Gravel Company, Inc. It replaced a 4′ x 20′ revolving screen. Here is an on-the-job report in the words of Harold Green, plant superintendent.

"Since installing the new screen, our production has increased about one-third and we are also able to produce one more grade of material which is in good demand, and was unobtainable with the revolving screen.

"We figure the screen paid for itself on one job, as we were able to meet specification on an abrasive sand that we could not have bid on, had we been using the old equipment.

"We are very pleased with the screen and to date, other than changing screens, we have not had a wrench on it."

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IN CANADA:

UNITED STEEL CORP., TORONTO, ONTARIO

by the cement but by its abuse. This abuse is said to be chiefly the use of *bad* aggregates and poor construction practices.

"From experience described in this paper the cement used was improved by use of a natural cement blend, and/or a slight amount of air entrainment. For our purpose here it does not matter which one or both, or how and why. The answers to that are still largely theory, anyhow. The point is that because portland cement is a *manufactured product*, it is capable of quality change, or even of improvement, through change in its ingredients or processing, or both. Now let's look at the other ingredients of *concrete*.

"Aggregates are what the good Lord provided. They are *natural* products. No amount of processing will change their fundamental physical and chemical characters. It is silly and futile to seek the *perfect* aggregate in parts of our country where such is not economically available.

"With the rapidly increasing exhaustion of economically available sources of presently accepted aggregates, there is every prospect that we shall have to do in the future with less acceptable aggregates rather than better ones.

"It is not only logical but inevitable, therefore, that we learn to adapt our cements to the available aggregates, not the aggregates to the cement, as seems to be the present approach. A little reasoning ought to show that it is the manufactured product that can be changed, not the natural one.

"What makes bad aggregate or bad concrete? The answer to that simple question becomes more involved and complicated with every new investigation of concrete failure. Need the answer be so difficult?

"Water alone may be responsible—the water that is retained as water in the hardened concrete and the water absorbed by the hardened concrete from rain, snow and soil. We have yet to hear of concrete, such as in interior walls of buildings, which is kept continuously dry, failing because of aggregate reactivity or because of *thermally incompatible* aggregates.

"Obviously one can not get alkali cement reaction with siliceous aggregate if solutions or colloidal sols are not present. And it takes water or some other liquid to form a solution.

"Various experts account for some bad concrete because of aggregates of different coefficients of expansion—thermal incompatibility it is called. These coefficients vary from about 7 x 10^{-6} for trap rock to 11 x 10^{-6} for some 'bad' gravels. The coefficient for cement paste is about 7 x 10^{-6}, but varies greatly with the kind of cement and the water cement ratio.

"Apparently no one has taken into consideration that water also has a coefficient of thermal expansion. One gram of water makes one cubic centimeter at 4 deg. C. Changing in either

direction from 4 deg C. causes one gram of water to require more space. In changing from 4 deg C. to 50 deg. C. one gram of water expands to 1.01207 c.c. in volume. Reduced to a coefficient of expansion per degree C. this is 262 x 10^{-6}. But, being a liquid it has no true measure of linear expansion as does the concrete. The 262 is the coefficient of cubical expansion, since water expands equally in all directions. However, the cube root of 262 gives us the equivalent of linear expansion, and this is about 6.4 per degree C. or 3.5 per degree F. (see footnote).*

"The expansion of water with a rise in temperature is not uniform. It increases as the temperature of the water increases. The cubical coefficient of expansion between 30 deg. and 40 deg. C. is 347 instead of 262. On this basis the "linear" coefficient of expansion is about 4.2 x 10^{-6} per degree F., which is about the same as some limestone aggregates.

Incompatible Water Aggregate

"Just consider, however, that water is practically incompressible, and therefore perfectly elastic. Consider also that the water in cement paste or concrete, or most of it, is confined in narrow capillary pores or channels, many below microscopic size. Obviously the water will then expand in the direction of least resistance, which normally would be lengthwise along the channel. If the water thus expands in one direction only, its 'linear' coefficient of expansion would be three times that given, or from 10.5 to 12.6 x 10^{-6}, which would make water the most 'incompatible' ingredient or aggregate in the concrete from a thermal angle. If it is gel water compressed to 0.8 of its normal volume, its coefficient of expansion must be correspondingly greater. It has an additional disadvantage, compared with other ingredients. It is perfectly mobile.

"P. H. Bates, of cement and concrete fame, once estimated that even the best ordinary concrete contains over 8 percent of free water on a volume basis, not counting about an equal amount which is generally assumed to be 'combined water.' Recent research, however, lends evidence that very little of this 'combined' water is anything else than water firmly held in the finest pores and capillaries of the cement gel. Hence, there is about as much water in concrete as there is cement. Why we should neglect to consider its expansion and contraction caused by temperature changes other than freezing and thawing is difficult to comprehend.

"Water similarly retained in fine grained aggregates is also, of course,

*We have since learned that the correct way to determine linear expansion from three dimensional volume expansion is to divide by 3 and not take the cube root. This would make the "linear" expansion of water 87.3 x 10^{-6} per degree C. instead of 6.4, or more than 12 times as much. Hence if water expands in one direction only its expansion in that direction would be about 12 x 12 = 144 x 10^{-6}, which would make it many times the most "thermally incompatible aggregate."

subject to expansion and contraction from temperature changes, and that is probably the reason some chert and fine grained limestones are objectionable as aggregates. But even the worst does not contain as high a percentage of water as does the concrete. It is probably not so much the silica or the calcite that causes damaging expansions as it is the water in the fine pores and capillaries. We do not need freezing and thawing tests with such water-saturated concrete and aggregates. Various experimenters have found that alternate wetting and drying will cause the same kind of disintegration. It must be the volume change in the retained water as well as the change in the amount of absorbed water that is responsible for the damage.

"One advantage which so-called 'bad' aggregates have over the cement paste, or the concrete, is that they can be dryed out beforehand. This is not so difficult, for mere air drying in loose stacks or stockpiles often serves the purpose in hot, dry summer weather. Thus, objectionable aggregates, produced and stocked a season or two in advance of use, might be rendered entirely serviceable, even with ordinary portland cements.

"The same principles apply to pavement construction practices. After the concrete has been placed, hardened and cured, it is probable that a good drying out is helpful. That is why, apparently, pavements laid early in the season often give better service than pavements laid in the fall, although both may have the same kind of cement and aggregates. Once thoroughly dryed out, some change evidently takes place in the kind of porosity, so that the material will not again absorb as much moisture of the damaging kind under ordinary conditions as it once contained.

"One advantage of a base course of granular material is probably because it drains out of the setting concrete some of the excess mixing water prior to final hardening and curing. Most highway engineers think of this granular course only as insulation against subsequent absorption of water from the subgrade.

"It would appear then that any cement, aggregate or construction method which reduces the water retained in the hardened concrete, or prevents the absorption of rain, snow or ground water is a step in the right direction.

"Portland cements blended with natural cement, pulverized granulated slag, or a pozzolan evidently help make a cement paste with less free water, either by making a denser product through requiring less mixing water, or by using the retained water for forming crystalline products, which fixes the water chemically—that is, it is not longer *free* water."

Sales Record

DANT & RUSSELL, INC., Dantore Perlite Div., Maupin, Ore., sold 500,000 3-cu. ft. bags of Dantore in 1950. This quantity was estimated to be sufficient to cover 7,500,000 sq. yd. of plastered surface if all were placed on rock lath.

M.L.P.A. Meet

(Continued from page 71)

whose firm is no longer engaged in the business of producing or distributing agricultural limestone.

Retiring board members are J. Griesemer, Billings; Merl Hamill, Canton; and L. W. Hayes, Kansas City. Each of these men has served as a M.L.P.A. board member since it was organized in 1946. They were given an ovation in appreciation of their thoughtful guidance and untiring effort.

Officers of the new board who will serve through the calendar year are Ben P. Donnell, Valley Dolomite Corp., Bonne Terre, president; Buford V. Everett, Everett and Clark, Plattsburg, vice-president; and Kenneth Kilkenny, West Plains, secretary-treasurer. Other board members are E. M. Markwell, Auxvasse Stone and Gravel Co., St. Louis; George M. Baker, Lockwood; and Charles E. Thomson, Deitz Hill Development Co., Kansas City.

As is usually the case at M.L.P.A. conventions, the social hour preceding the annual banquet was the highspot of the meeting for most guests. This year's host at the cocktail party was Columbia Quarry Co., Horace C. Krause, president, St. Louis.

Silica Producers Discuss

(Continued from page 72)

apparent. Lack of loyalty was also blamed for a share of the present situation.

It was said that 13.96 days was the turn-around time for box cars, 18.88 days for covered hoppers, and 16.42 for tank cars, and that none of these days could be the shipper's fault. Another member told of an eight-day requirement for a 65-mile haul and thought that some scheme should be worked out whereby railroads would be required to pay demurrage. In New Jersey empty box cars had been observed staying in the yards for three weeks. Gary, Ind., at one time had about 1000 cars piled up in the yards.

One member asked for experience on the laminated-type box car. It was said it is a good car but builders were having trouble getting materials. It was said that a car priority plan had been talked about in Washington, but nothing more had happened.

In summarizing it was said that one way to get empty cars was to go to the rail yards, jot down the car number of any empties observed, and take these car numbers to the local agents. Often results could be obtained quickly. A letter to the Service Bureaus might also help, it was pointed out.

Legislation

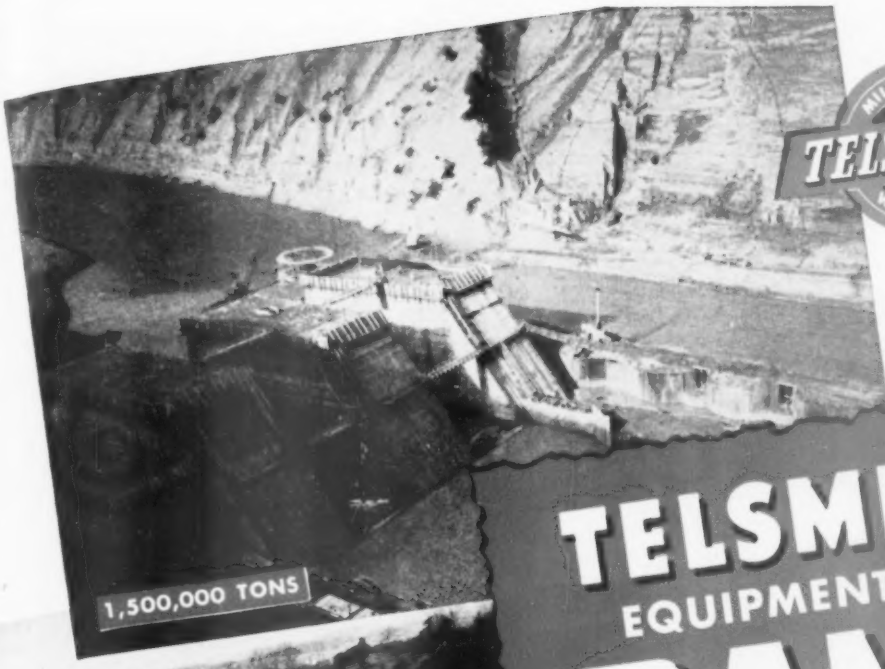
John Sapienza, attorney, Covington and Burling, touched on the excess profits tax and renegotiation laws. Walter Slowinski of the same firm discussed the technicalities of depletion, depreciation, and amortization.

At the noon luncheon the following men were at the speakers table and were introduced to the guests: Charles A. Horsky, counsel; Walter Acheson, Building Materials Division, Office of Price Stabilization; Harold A. Montag, chief, Requirements Division, Defense Minerals Administration, U. S. Department of the Interior; Francis B. Speaker, Requirements Division, Defense Minerals Administration, U. S. Department of the Interior; William Callahan, manager, Open Top Car Section, Car Serv e Division, Association of American Railroads.

Mr. Montag is on loan to the Defense Minerals Administration from the Jeffrey Manufacturing Co., and Mr. Speaker is on loan from Hewitt-Robins. Mr. Acheson was formerly president of the Wabash Valley Ready Mixed Concrete Association.

Mr. Callahan spoke briefly on the car situation and said there would be no car priorities if the railroad association had anything to do with it. He said 92,000,000 tons of iron ore may come down through the Great Lakes and the car shortage may get worse before it gets better.

At the afternoon session, wage and price controls and procedures were informally discussed. In general it developed that it was not good practice to run to a control agency for a minor



Mount Morris Dam, N. Y. The 300-350 tons per hour rock crushing plant is Telsmith designed and equipped.

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- Conowingo Dam, Conowingo, Md.
- Dale Hollow Dam, Tennessee
- Davis Dam, Nevada
- El Presidente Dam, Mexico
- Fort Gibson Dam, Oklahoma
- Grand Coulee Dam, Washington
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- Norfork Dam, Arkansas
- South Holston Dam, Tennesse
- Watauga Dam, Tennessee

● Huge dam projects and Telsmith Aggregate Plants go together. Many dam builders call in Telsmith engineers for consultation as to the proper plant layout and the right equipment to use. Then Telsmith makes the detailed drawings for the erection of the plant and furnishes most of the machinery. Telsmith designed plants have proven their efficiency on many large projects and Telsmith equipment has a world-wide reputation for the production of low-cost aggregate. The ruggedness of Telsmith equipment is strikingly demonstrated by long life in severest service, on successive projects. After producing 1,500,000 tons of aggregate at Center Hill Dam, the same Telsmith equipment is now turning out about the same amount of aggregate at Buggs Island Dam.

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MP-8

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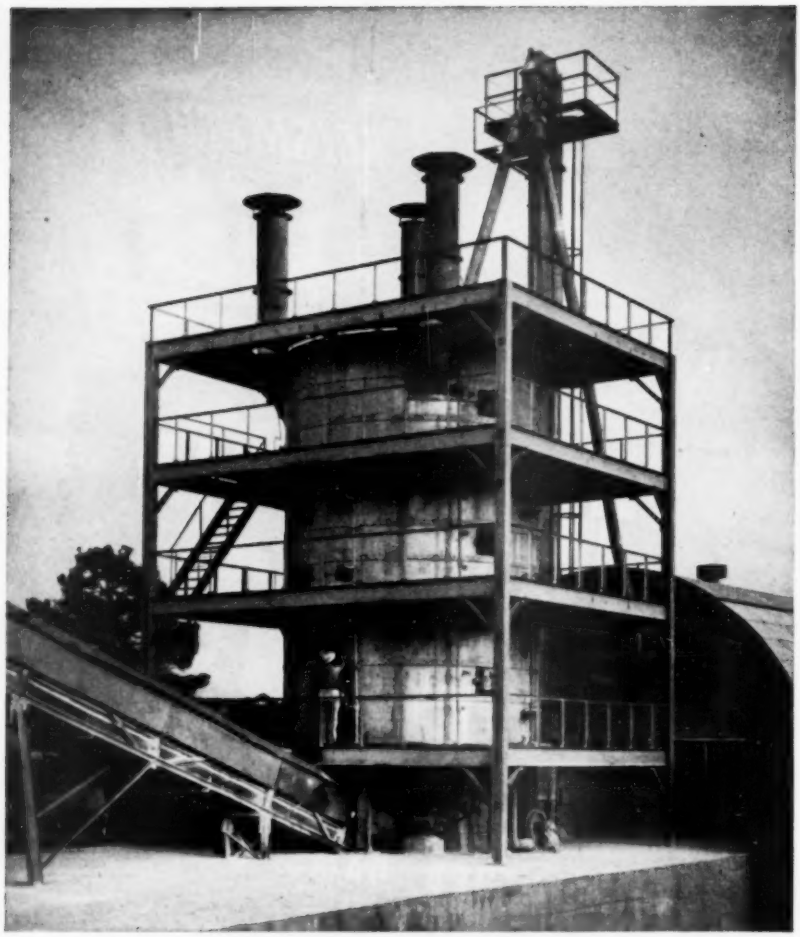
Clyde Eqpt. Co., Portland 9, Ore., & Seattle 4, Wash. • Mines Eng. & Eqpt. Co., San Francisco 4, Calif. • Interstate Equipment Co., Statesville, N. C.

Rish Eqpt. Co., Charleston 22, & Clarksburg, W. Va.—Roanoke 7, & Richmond 10, Va. • Wilson-Weesner-Wilkinson Co., Knoxville 8, & Nashville 6, Tenn.



decision and that one should at times be willing to take calculated risks. In the defense set-up, big business is in the saddle and little business, caught in the vise of rising costs, price ceilings and wage controls, may find it difficult to survive.

The industrial sand group felt that if it could get supplies, parts, and labor, plus a modest amount of capital equipment, it could supply all the foundry and industrial sand needed.

Rocky's Notes

(Continued from page 49)

on cement chemistry point out. For example, there is crestmoreite (2 $CaSiO_3.3H_2O$), also called riversideite, found only at Crestmore, Calif., in veins of calcite and vesuvianite. It is an Insosilicate, or silica tetrahedrons in chains with two oxygen linkages. Vesuvianite is anhydrous silicate with calcium, magnesium, iron and aluminum atoms, and is apparently a hydrothermal product, the water having been converted to O and OH ions. This calcium silicate is probably a freak separation product.

Wollastonite is natural calcium silicate ($CaSiO_3$) or an anhydrous monocalcium silicate in portland cement terminology, $CaO.SiO_2$. It is very scarce, found in but two or three places on the Earth. Two extremely rare hydrous calcium silicates, both with the formula $Ca_3Si_2O_7.3H_2O$, are foshallassite in Russia, and afwillite in South Africa. These are Sorosilicates, or groups of SiO_4 tetrahedrons with only one common O linkage. Their portland cement formula would be $3CaO.2SiO_2.3H_2O$.

Kiln Efficiency

(Continued from page 75)

of improved type should do it for less and eventually may produce a ton of lime for 20 cu. ft. which is one of the logical ways of controlling radiation loss.

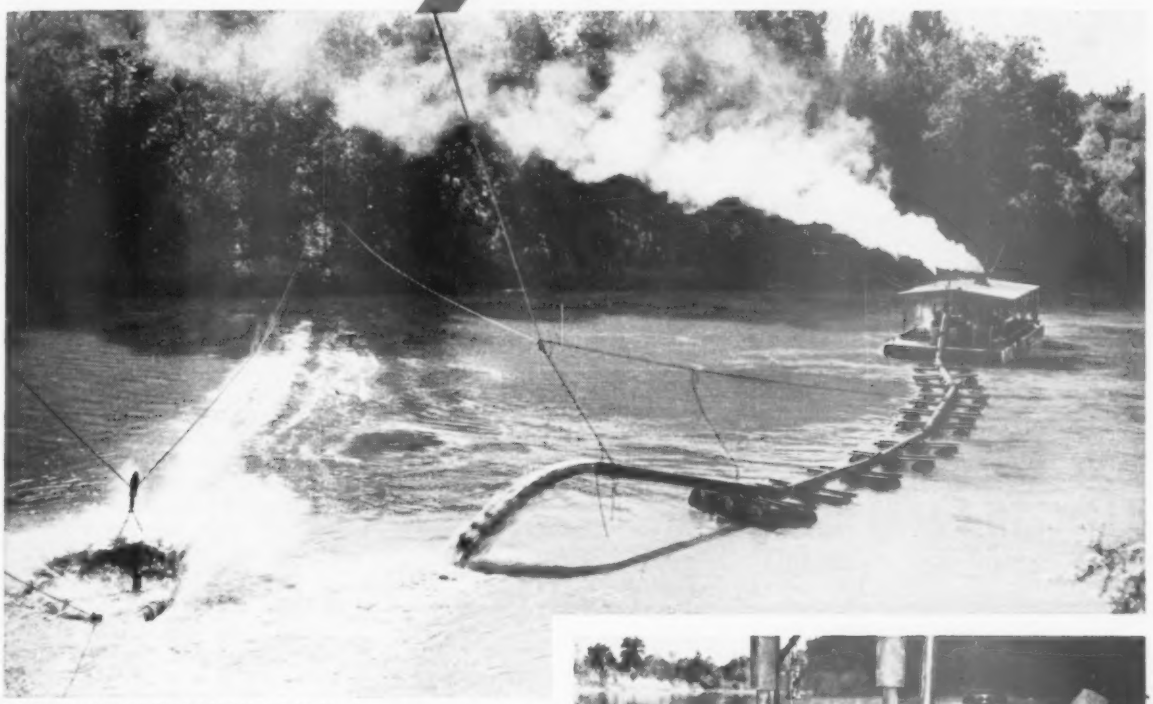
Thus the 35 cu. ft. line in Fig. 7 serves as a border line. It represents the best record for the kiln of the past, and it is representative of the worst record for the rationalized kilns of the future. To accomplish the ultimate goal we must, among other things, control radiation, and that means moving to the left of the 35 cu. ft. limit line, which is vitally important since radiation loss may be 70 percent of the heat in the lime. In cement kilns it is even more and is at least equal to the net heat of calcination reaction, not recoverable through recuperative action.

(To be continued)

Votes Pensions

MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio, recently announced that the stockholders of the company have approved two pension plans covering all employes, numbering about 1200.

All Day Sucker

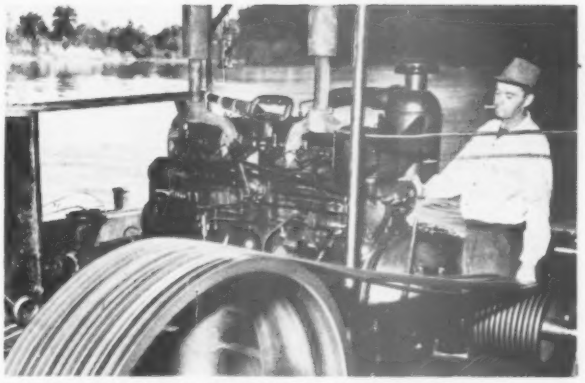


ROADS FROM RIVER BOTTOM! UD-24 Diesel power pumps sand and gravel to be used for highway improvement in Arkansas and Missouri.

Big International UD-24 sucks 1,400 cubic yards of sand and gravel every day from Black Rock river

Hour after hour this International Diesel forces a high-pressure stream of sand and gravel through a 200-foot pipe to the river bank. "The UD-24 does the job fine and has enough surplus power to run all the extra barge equipment," says owner R. C. Tate, Black Rock, Arkansas. "And the engineers like its quick starts and easy maintenance."

Steady performance and big working capacity of International engines make them favorites where low-cost, nonstop power is needed.



POWER FOR PUMPING PROFIT is furnished by this UD-24 Diesel. Owner R. C. Tate is mighty pleased with this unit.

Get the whole story on these profit-making power plants from your International Industrial Distributor or Power Unit Dealer. Take a look at his stock of approved parts and efficient service facilities. You'll find out why Internationals give you dependable, profitable power for years to come.

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INTERNATIONAL INTERNATIONAL HARVESTER **POWER THAT PAYS**

Safety

(Continued from page 81)

an interesting subject and it can be made to pay dividends rather than be a debit. Since we started a safety program throughout our plants three years ago, our premium has been reduced 15.7 percent and more savings are to follow since the premium is based on a three-year experience for each year.

In concluding this article, I can only point out that safety is a production tool and that every aid given an accident prevention program is a means to increase production and to save our insurance premiums, to say nothing of alleviating pain and suffering. This monthly get-together for an exchange of ideas, operating methods and practical solutions to safety and production problems is such a tool and in our area has proved its worth.

I would be glad to assist anyone who is desirous of starting such a group as just outlined, by providing copies of our by-laws, programs, mimeographed reports of meetings, and in any other way possible. If you have an urge at all to get started, I believe you can find kindred spirits to go along with you. We in New York State are no different than others and if we can put a program over here, it can be done elsewhere.

Labor Relations Trends

(Continued from page 51)

"2. Respondent also alleges that the agricultural ground limestone called for in the contracts came within the exemption for 'agricultural or farm products processed for first sale by the original producer,' contained in Section 9 of the Act.

"The Secretary of Labor has defined this exemption as including only 'products which are the result of operations incidental to or performed in conjunction with farming operations as well as those products raised by farmers as a result of planting or cultivation.' * * * * This provision was not intended to exempt producers of goods and materials which may be sold to farmers for use in growing or cultivating their crops, except where such goods or materials are produced by a farmer or on a farm as an incident to or in conjunction with his farming operations.

"The fact that respondent owned a farm at the same time that he conducted a limestone business would not bring his limestone business within the agricultural exemption. The major portion of respondent's limestone business was that of selling to the Government; a small percentage was sold commercially to farmers. There were no farming operations carried on at the location of respondent's quarry. There is no evidence that respondent's limestone business was carried on as incident to or in conjunction with his farming operations. It must therefore be concluded that the limestone op-

erations do not fall within the exemption.

"After consideration of the entire record, I find that the examiner's findings of fact are supported by the record and his conclusions of law are correct. Accordingly, it is hereby ordered: That the respondent pay to the United States the sum of $1772.64 as liquidated damages for failure to pay overtime compensation to persons employed in the performance of contracts subject to the Public Contracts Act.

"I concur in the examiner's recommendation that respondent be relieved of ineligible list sanctions of Section 3 of the Act."

Comment

Probably some producers of rock products other than agricultural limestone have considered themselves secure from prosecution by the Labor Department investigators, when filling U. S. Government orders, or in making shipments to others based on bids submitted to some department or bureau of the federal government, so long as the total did not exceed $10,000. There have been perhaps cases where the purchasing agent for the government has purposely split an order into segments so that no single order would exceed $10,000. It would appear from the reasoning in this case that the Labor Department will investigate and hold producers to account under the Walsh-Healey Act for any one of these agreements, or for their sum total over a period of years —in the case cited about, the period was over two years.

We believe that the producer still has the right to appeal to the U. S. Courts, and the U. S. Supreme Court in a recent decision has specifically restored the neglected rights of the courts to hear controversies arising from the interpretation of the laws by the various administrative agencies. It obviously adds to the cost of limestone to the farmer if labor required to produce it must be paid time-and-a-half for anything over 8 hours in any one day of a brief operating season. For example, in many quarries production is interrupted on rainy days, and suppose there were three such days in a week. If the men were asked to work 12 hours a day to make up for time lost on account of the rains, they would work but 36 hours in the week, but their overtime would be 12 hours at time-and-a-half. Even though a producer has been complying with the Fair Labor Standards Act and paid for overtime after 40 hours a week, he would still be subject to the Walsh-Healey Act, should he have fulfilled any orders in response to a government call for bids.

Changes Address

UNIVERSAL ATLAS CEMENT CO., recently announced the removal of its offices from 135 East 42nd St., to 100 Park Ave., New York, N. Y.

Difficulties of Sand and Gravel Production in England

THE EDITOR: I read your January "Rocky's Notes" with both interest and amusement. Actually you interpreted your comments from the Gravel Advisory Committee's report fairly well without close knowledge of our new Town Planning Laws. However, I will correct your little slips.

The gravel producers here *do* own fee simple of their land in majority, but when our "Planning Act 1947" reached its operative date July 1, 1948, the Government secured the development value of all property, e.g., land or buildings, and whenever a "change of use" in either takes place, the development is assessed, and a Development Charge has now to be paid.

On gravel producers briefly it works like this:

(1) 100 acres of gravel bearing land now used as agriculture; they say its surface value is (perhaps) £30 an acre.

(2) If the Local Planning Authority give consent for gravel extraction, then a special "Central Land Board" examine its yield. Say 40,000 tons per acre and assess you (say) 6d per ton or £1,000. (Less value as in No. 1.)

It will be noticed then the fee simple ownership of land is now only the surface value to owner, and its development whether for extractive use or say *any change of use* increasing its value over its use on vesting date, is debited with a Government Development charge.

(3) Where a gravel producer *was* extracting on vesting date and had contiguous land in reserve and held a "planning consent" a 3-year moratorium freed him from development charge till July 1, 1951. All unexhausted acres at July 1, 1951, are to be paid for by the government in compensation less surface value. Say 80 acres x £1000 unrestricted value, less £30 restricted value. This will go to the Producer's Suspense Account, and set off against this will be his annual Development Charge, until one exhausts the other.

But, all *new* producers after July 1, 1948, commence paying at once, being debited with a Development Charge—anything from 6d to 9d per ton, according to the value of the mineral in that specific district. The owner still owns his fee simple, and if restored can sell it, but any subsequent re-use can attract a further charge, say works built upon it, just as the formula above. Actually it is a *land-use charge* even to use your own. If the developer takes the land on royalty he pays the charge not the lessor.

"Amenity"

Your amenity interpretation amused me but was quite correct.

We have to preserve every acre of

land possible and moreover minimize ugly defacement to public eye. Thus we pay due regard to amenity.

When applications are submitted for "Consent" every Government department, e.g. Agriculture; Rivers Board; Drainage Authority; Ministry of Works and so on are first consulted by the Local Authority. If, as recently as last week we applied for land in a hilly woodland and beauty spot, people object and usually do in the press, and it gets too intensive, then a Public Inquiry follows and the Ministry of Town and Country Planning, London, decides the issue over the authority of the Local Planning Authority.

We are now subject to imposed conditions in a consent:

(*a*) Plant screening trees and spoil not above level surrounding land.
(*b*) Expansive berms for lateral and vertical support to rivers.
(*c*) No pumping of waste solids or fines into a river or drainage stream.
(*d*) Margins with batters to natural angle of repose.
(*e*) Demolition of plant and everything clean when exhausted, and sometimes complete restoration. Everything in fact to be a "good neighbor."

When the *last* report (not yet done) appears you will see the Gravel Advisory Committee are to make proposals for some method of "restoring" and devising a scheme to *pay* for restoration of all extractive land.

We contend it is a "Production" cost, and must pass it on to the consumer, but its agreement upon that basis meets with political opposition, or more correctly its effect upon market increases will cause those devising a scheme considerable complexity.

It may surprise you to know that many producers voluntarily restore, and this is becoming almost universal here now. (I send you a book with a section upon this). Moreover our producers are planting with great artistic care, trees 18 to 20 ft. high for screening, and the concrete drives to their pits are like entering a park with ornamental flowering trees and shrubs each side of the drive, and they look bonny.

We are living down and eliminating the "bad lad" legacy of our forebears and doing it in this generation.

I send you parts 1-5 of the Report and you will get a better viewpoint in part 1, Introduction.

The power of Town and Country Planning is an English Statute Law but the report of the Advisory Committee is research by that body set up by the Minister to help him apply Planning Law wisely, and when complete will be either adopted wholly or in part by the then Government of the day. It was necessary because the reserves were depleting and a census and wise use over next 25 to 50 years was essential, to:

(*a*) Prevent waste.
(*b*) Prevent sterilization for other

competitive uses of land.

I send you several books, one just out "Control of Mineral Working," so you may appreciate the problem here. The geography professors are geologists of wide knowledge also.

I should need several days to lecture on the complex Planning Law here, but it is most interesting and very *wise* in the main, although I fear Development Charges may in other spheres impede development.

When one builds a factory not only the cost of this, say £100,000, has to be met, but a heavy development charge also. Consequently old buildings are unwisely reverted to in order to limit the initial capital charges. Offset against this is obviously the land *will* or *should not* cost more than 1939 *surface value*.

Leeds, England.
March 19, 1951.

C. MAW, Manager,
The Stanley Ferry Gravel Co. Ltd.

New Incorporations

Badger Perlite Products Co., Milwaukee, Wis., was recently incorporated with 4000 shares of class B, non-voting and 10 shares of class A, voting stock. Minimum capital is listed at $1000. The company will produce plaster, concrete and asphalt. The incorporators are Florence Buck, Mary Clarke and Elaine Eisner.

Midwest Sand & Gravel Co., Roselle, Ill., has been incorporated with 100 shares of common stock, no par value, by John W. Kennedy, Estelle Kennedy and Anthony L. Clesceri. The company will deal in sand, gravel and by-products.

Acme Federal Concrete Corp., Hialeah, Fla., was recently incorporated with 100 shares of stock, no par value. Directors of the corporation are Paul S. Jacobs, Michael J. Zorovick and Samuel Zorovick. The company will deal in premixed concrete.

Plano Redi-Mix Co., Plano, Ill., was recently incorporated with 200 shares of common stock, par value, $100. The company will deal in concrete and concrete products. The incorporators are William C. O'Brien, W. M. Kewenig and D. L. Puckett.

Rantoul Ready Mix Co., Moline, Ill., was recently incorporated with 1000 shares of stock, p.v., $100. The company will produce and distribute ready-mixed concrete and building products. The incorporators are Jesse H. Freeman, Jaunita Freeman and Shirlie Freeman.

Median River Sand & Gravel Co., San Antonio, Texas, has been incorporated by J. E. Browning, H. W. Lewis and Wilson Lewis. Capital stock was listed at $40,000.

Brazilian-American Mica Corp., New York, N. Y., was recently incorporated with 350 shares of stock, no par value. Philip Lichtenberg is the incorporator.

MANUFACTURERS NEWS

Nordberg Mfg. Co., Milwaukee, Wis., has announced the death of C. Arthur Johnson, superintendent of production, crusher division, while on a visit to Mission, Texas, on February 18. He was 60 years old and had been associated with the company since 1928.

Swan-Finch Oil Corp., New York, N. Y., announces the appointment of Anthony J. Zino, Jr., as assistant to the president, Howard C. Moncrieff. Formerly sales promotion manager and chief lubrication sales engineer, Mr. Zino is author of numerous articles on lubrication which have appeared in technical publications.

Arkell & Smiths, Canajoharie, N. Y., has elected Carl A. Miller a director of the company. Mr. Miller is senior vice-president of the Irving Trust Co.

The Thew Shovel Co., Lorain, Ohio, at a recent meeting, presented C. B. Smythe, president, with a diamond award in commemoration of his 40 years of service with the company. R. P. Kelly, service manager, and E. R. Linn, a machinist, also received 40-year diamond awards, bringing the total who have qualified for this award to 14, six of whom are still in the employ of the company. The pictorial tabloid, "Thew-Lorain News," published by the company, celebrated its 100th issue with the March-April 1951 printing.

Walsh Refractories Corp., St. Louis, Mo., has been granted a certificate of necessity by the National Security Resources Board for expansion of its fire brick manufacturing facilities at Vandalia, Mo. The new plant is expected to be in full operation by early summer of 1951.

Austin-Western Co., Aurora, Ill., has announced the death of R. G. Milton, assistant advertising manager.

Chicago Steel Foundry Co., Chicago, Ill., announces plans for a more complete mechanization of its plant, including a new and modern furnace of larger capacity, conveying equipment and other machinery. Installation of the new equipment is expected to be completed by September or October of 1951.

General Electric Co., Schenectady, N. Y., has elected the following executive vice-presidents: Henry V. Erben, formerly vice-president of the company and general manager of the apparatus department; Hardage L. Andrews, formerly vice-president and general manager of the appliance and merchandise department; and Roy W. Johnson, formerly vice-president and general manager of the affiliated manufacturing companies department. Everett S. Lee has been appointed editor of the "General Electric Review," monthly engineering magazine published by the company. He succeeds Edward C. Sanders, who has retired after serving since 1926 as executive editor of the publication.

R. G. LeTourneau, Inc., Peoria, Ill., announces the appointment of James W. O'Connor and J. W. Gulledge to the field engineering staff.

IMPERMEABLE CONCRETE PIPE

Combination of centrifugal force, vibration and pressure compaction produces pipe of extraordinary strength and quality

By
M. W. LOVING

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2: George R. Jessen, president of the Utah-Idaho Concrete Pipe Co., Lake City, Utah, and the Idaho rete Pipe Co., Inc., Nampa, Idaho

trunnions and also stabilized ur arms fitted with pneumatic hich roll on the top-sides of the during the manufacture of the hese four arms, like the steel nd the three high-frequency vi- assemblies which transmit vi- on the undersides of the molds uated by hydraulic rams, all ed by the one operator of the . All this is more clearly pre- in the description of the ma-

the machine, molds, curing and all handling facilities are le but sturdy design. This ac- or the fact that the production the finished pipe are very and this is already proven al production records of the the Nampa, Idaho, sewers. Incidentally, this is the first time any city in the United States has received sewer pipe, actually pressure pipe of excellent quality, for such a nominal price.

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...maintenance or replacement, after the sewers are placed in service.

All of this is mentioned here just to emphasize how important it is to construct sewers right at the outset, with pipe and flexible joint assemblies that will actually prevent infiltration of ground waters into the sewers.

Required Pipe Quantities

About 900 ft. of 30-in. diameter reinforced concrete culvert pipe, made by

The concrete used to make this kind of pipe is very strong, dense and impermeable because it is pressurized by centrifugal force, supplemented by high-frequency vibration and compacted with a steel roller simultaneously. The steel roller is actuated with two hydraulic rams, one at each end of the pipe mold, with a total capacity of eight tons. This accounts for the trade name "Cen-Vi-Ro." The steel molds for the pipe are revolved on four pneu-

Pressurized Concrete and Tensioned Steel Reinforcement

The semi-dry concrete mixtures (called "earth-moist concrete" in Sweden and elsewhere) consist of about 70 percent of course aggregates and

R. G. LeTourneau, Inc., Peoria, Ill., announces the appointment of James W. O'Connor and J. W. Gulledge to the field engineering staff.

Pettibone Mulliken Corp., Chicago, Ill., announces that Phillip Levin has been appointed sales manager of the bucket division of the George Haiss Mfg. Co., Inc. He has been associated with the company since 1946.

Cummins Engine Co., Inc., Columbus, Ind., has announced a $400,000 extension to the recently completed DD fuel pump building in addition to new machinery for manufacturing the new pump and component parts.

Garlinghouse Bros., Los Angeles, Calif., has announced plans for construction of a warehouse and salesroom at 2415 E. Washington Blvd., adjoining a shop building which was recently built at that location.

Towmotor Corp., Cleveland, Ohio, has announced the appointment of E. C. Iverson as chief engineer. Mr. Iverson was formerly associated with the J. D. Adams Mfg. Co., Indianapolis, Ind.

Chase Bag Co., Chicago, Ill., has assigned R. J. Stevens as special representative of the Chicago general sales office.

Detroit Automotive Products Corp., Detroit, Mich., has appointed H. D. McPeak of Bronxville, N. Y., as sales manager of national accounts, with offices in New York and Detroit.

IMPERMEABLE CONCRETE PIPE

Fig. 1: One of the first pipe installed at a cut to invert of about 17 ft. in the Nampa, Idaho, sewerage system

Combination of centrifugal force, vibration and pressure compaction produces pipe of extraordinary strength and quality

By
M. W. LOVING

A MODERN SEWERAGE system is now under construction at Nampa, Idaho, which has a population of about 20,000. During the irrigation season, from April to October, the water table in the city (and surrounding farm lands) is always above the invert gradients of the existing and new sewerage systems. Thus, the prevention of infiltration of ground waters into the new sewers is a very important issue, to minimize sewage treatment and pumping costs and avoid structural defects, when the sewers are placed in service.

The intercepting and outfall sewers are being constructed with reinforced concrete pressure pipe, manufactured in diameters of 18, 24 and 30 in. and laying lengths of 10 ft. To provide watertight joints that will remain so and which are flexible to take care of expansion, contraction, settlement or lateral displacement, round rubber gasket joint assemblies are required for every pipe of the type shown in Fig. 21.

A large percentage of the sub-soil in Nampa consists of sand, silt and the like; when saturated with ground waters it becomes a fluid soil-mass. Unless the joints of the pipe sewers are made tight, and remain watertight, there is always the potential danger of structural failures. Such failures are caused when the fine sand and silt are transported in suspension by ground waters through defective joints into and out of the sewers. In such cases, the pipe may settle and pull apart at the joints and require expensive maintenance or replacement, after the sewers are placed in service.

All of this is mentioned here just to emphasize how important it is to construct sewers right at the outset, with pipe and flexible joint assemblies that will actually prevent infiltration of ground waters into the sewers.

Required Pipe Quantities

About 900 ft. of 30-in. diameter reinforced concrete culvert pipe, made by the centrifugal process in 8 ft. lengths, were required to construct the sewer under the yards of the Union Pacific Railroad Co., where the elevation from the top of the pipe to the base of the rails is about 3 ft. During construction of the sewer, the tracks were removed one at a time and re-laid after the pipe sewers were constructed. With the very limited headroom, this was the most economical and practical method of constructing the sewer under the 11 tracks, because the pipe were carefully bedded and backfilled with compacted soil which prevented settlement of the tracks at the site. Centrifugal pipe was used for this section of the sewer because the Cen-Vi-Ro pipe, discussed in this article, was not in production in time for its construction.

Approximately 11,300 ft. of 30-in. diameter pipe, 4300 ft. of 24-in. and 3920 ft. of 18-in. diameter pipe, all made by the Cen-Vi-Ro process, are required for the intercepting and outfall sewers. Besides, for the lateral sewers and smaller intercepters, about 1700 ft. of 15-in. diameter reinforced concrete sewer pipe, 3850 ft. of 12-in. diameter reinforced concrete sewer pipe and 50,500 ft. of 8-in. diameter concrete sewer pipe are required for the new sewerage system. The 220 manholes are also constructed with 48-in. diameter reinforced concrete pipe, each fitted with precast top cones which are 24 in. in diameter at the top and 48 in. at the base.

Cen-Vi-Ro Concrete Pipe

The concrete used to make this kind of pipe is very strong, dense and impermeable because it is pressurized by centrifugal force, supplemented by high-frequency vibration and compacted with a steel roller simultaneously. The steel roller is actuated with two hydraulic rams, one at each end of the pipe mold, with a total capacity of eight tons. This accounts for the trade name "Cen-Vi-Ro." The steel molds for the pipe are revolved on four pneumatic trunnions and also stabilized with four arms fitted with pneumatic tires which roll on the top-sides of the molds during the manufacture of the pipe. These four arms, like the steel roller and the three high-frequency vibrator assemblies which transmit vibration on the undersides of the molds are actuated by hydraulic rams, all controlled by the one operator of the machine. All this is more clearly presented in the description of the machine.

Fig. 2: George R. Jessen, president of both the Utah-Idaho Concrete Pipe Co., Salt Lake City, Utah, and the Idaho Concrete Pipe Co., Inc., Nampa, Idaho

Yet the machine, molds, curing jackets and all handling facilities are of simple but sturdy design. This accounts for the fact that the production costs of the finished pipe are very nominal, and this is already proven by actual production records of the pipe for the Nampa, Idaho, sewers. Incidentally, this is the first time any city in the United States has received sewer pipe, actually pressure pipe of excellent quality, for such a nominal price.

Pressurized Concrete and Tensioned Steel Reinforcement

The semi-dry concrete mixtures (called "earth-moist concrete" in Sweden and elsewhere) consist of about 70 percent of course aggregates and

Fig. 3: The semi-dry concrete mixture is dumped from the 52-cu. ft., paddle-type mixer into the hopper of the charger

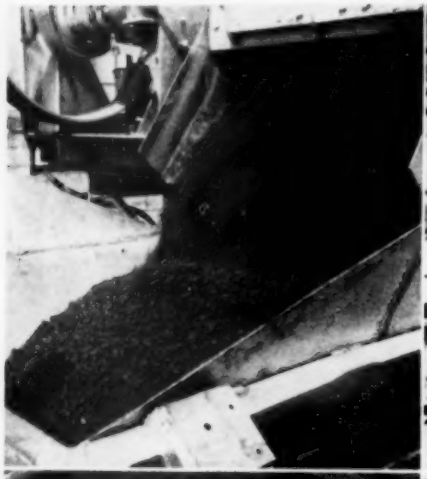


Fig. 4: Belt-type charger with 1-cu. yd. hopper in the background. Concrete mixture flows without aggregate separation

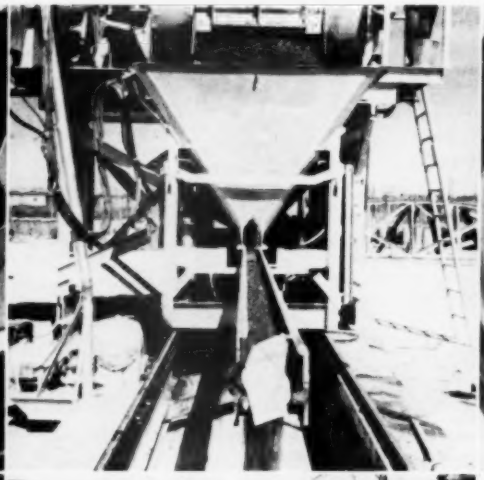


Fig. 5: Charger filling the bell-end of a 30-in. dia. pipe, 10 ft. long. The concrete is fed into the mold in uniform layers

Fig. 6: At any time, after spinning and vibrating, the mold can be stopped and concrete adheres to the upper half as shown

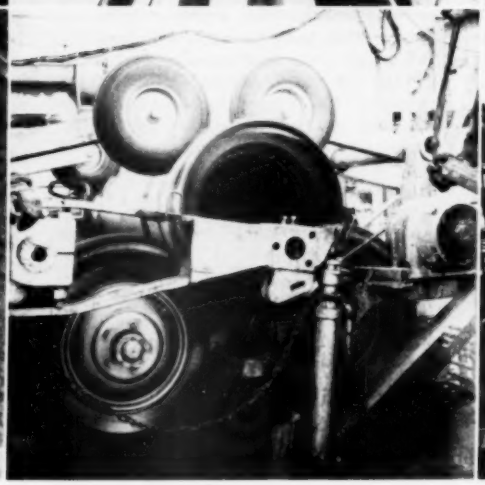


Fig. 7: Showing the pipe machine in operation. The steel roller pressurizes the concrete and tensions the steel reinforcement

Fig. 8: After the stabilizers are elevated with hydraulic rams, the mold and new pipe are removed with this boom machine

30 percent sand with a cement content of five bags per cu. yd. of concrete. Just enough water is used to hydrate the cement properly and the concrete is mixed in a 52-cu. ft. paddle-type mixer for at least five minutes. This assures uniform dispersion of the cement throughout the batch of one cubic yard of mixed concrete (see Figs. 3 and 4). The concrete must be transported with a belt conveyor from the hopper to any point in the length of the pipe mold. This charger is also controlled by the one operator of the machine with push-buttons, always in his hands while the pipe is being made. The concrete is fed into the molds in layers while the mold revolves at a rim speed of about 500 ft. per minute for the 30-in. diameter pipe and about 1000 ft. per minute for the 18-in. diameter pipe. Meanwhile, the vibrators are in operation and the concrete is consolidated between the mold and the spiral-wound reinforcement assemblies. This avoids distortion of the steel assembly which is made truly concentric, and is held that way in the molds by four steel spacers, welded to each of the four longitudinal members which extend to the molds. At any time, the mold can be stopped and the concrete adheres to the upper half as shown in Fig. 6.

This is accomplished by centrifugal force, supplemented by high-frequency vibration, because the steel molds are completely isolated by the pneumatic trunnions by which they are revolved, and stabilized by the arms of the machine which are also provided with pneumatic tires which roll on the top sides of the molds. Thus, these tremendous forces are utilized to the maximum degree in consolidating and pressurizing the concrete in the molds. After the molds are filled with concrete from one end to the other in uniform layers, the concrete is pressurized with the steel roller which is provided with corrugations. This brings the free water and fines to the surface. The interior surface of the pipe is then given a smooth finish.

There is no separation of the cement, fine and coarse aggregates in the shells of any pipe, and at the

Fig. 9: One of the two curing lines, showing the corrugated metal pipe steaming jackets

same time the entrained air in the concrete mixture is expelled. This is proved beyond any shadow of doubt, by the internal hydrostatic pressure tests of one day old pipe, discussed and illustrated with pictures here. The most interesting aspect of the new process is that the circumferential steel is tensioned under the enormous pressure to which the dry concrete mixture is subjected. The bond strength of the concrete to the steel reinforcement is always excellent because the free water and entrained air in the concrete mixture are expelled by these tremendous forces.

This is also proved by the hydrostatic testing, because many pipe, after only 22 hr. of steam curing, have been tested for 72 hr. or more under internal hydrostatic pressures from 40 to 50 p.s.i., without any moist spots on the external surface of any pipe. Remember, this pipe is designed for external loading and not for internal hydrostatic pressure. I saw this demonstrated for the first time at Boise, Idaho, in July, 1950, when the Cen-Vi-Ro process was in its early stages of development. The 30-in. diameter pipe shown in Fig. 18 was manufactured and tested in my presence in March, 1951. It was steam cured only 22 hr. and subjected to an internal pressure of 40 to 50 p.s.i. for 72 hr. You can see that there are no moist spots on the surface of the pipe.

Steel Reinforcement Assemblies

The steel reinforcement assemblies, which are commonly called cages, are truly concentric because the circumferential members are spiral-wound on mandrels. One finished cage is shown in Fig. 13. In the case of sewer pipe, made in long lengths, it is customary to tack-weld four longitudinal steel members to enough circumferential members to form a rigid cage. As said before, four steel spacers are welded to each of the longitudinal members which extend to the inner surfaces of the molds. Thus, the cage is held in place while the concrete is first consolidated and then pressurized.

Description of Cen-Vi-Ro Machine

In Fig. 7 a 30-in. diameter and 10-ft. long pipe is shown being manufactured in March, 1951. You can see the mold revolving on the four pneumatic trunnions and that it is being held down or stabilized by the four arms, actuated by two hydraulic rams, and fitted with pneumatic tires which roll on the top, side of the mold. Unless the pneumatic trunnions are employed when the concrete is spun, vibrated and pressurized with the steel roller simultaneously, it would be impractical and no doubt impossible to manufacture pipe in this manner. If steel trunnions were used, they could not stand up under the continued vibration; besides, excessive heat would be generated and the maintenance costs would be out of the question.

After the pipe has been manufactured, and it takes only ten minutes to make this pipe (total time on and off the machine), a Model 150 Hyster which is fitted with a special boom-attachment lifts the mold off the machine and transports it to the curing line. Only one Hyster of this kind was in operation at the outset; as a consequence the machine was idle for about ten minutes. Another Hyster can be placed in service and thus the interval of production lag may be reduced to about two minutes.

Pipe Curing

The curing area is paved with concrete, as shown in Figs. 12 and 14, and is 240 ft. long and 140 ft. wide. Notice one of the two manifold troughs which are 10 x 10 in. and accommodate steam, water and air lines; also the benches, one inch in width on each side of the manifolds which are provided to seat 12-in. by 2-ft. long wood blocks, each 2 in. in thickness. These are covers for the manifold troughs. This is done to provide access to the steam, water and air lines, at any curing station. The curing jackets are made of corrugated metal pipe. At long last, we have a good use for "tin whistle" pipe. All of the curing jackets are 13-ft. high and each one is provided with a thermometer so the curing temperatures can always be controlled. There is no guess work anywhere in this plant. The tops are all solid and are about 8-in. high in the center, so no condensed steam will drip on the fresh concrete inside of the molds. At each of the 64 curing stations, which accommodate 64 pipe, one bell forming-ring is always at hand, as is one curing jacket. Each mold has two sets of forming-rings and at every third station there is always space to accommodate one of the curing jackets. Rubber hoses, fitted with glad-hand connections at each end, convey the steam from the steam lines into the curing jackets. The internal diameters of the steaming jackets for the 30-in. diameter pipe and their steel molds are 48 in.; for the 24-in. pipe and molds, 42 in.; and for the 18-in. diameter pipe and molds, the internal diameters of the jackets are 36 in.

Meanwhile, the molds with the new pipe in them are transported from the Cen-Vi-Ro machine to their curing stations with a Model 150 Hyster as shown in Figs. 8, 10 and 11. This Hyster then picks up another empty mold assembly, with the steel reinforcement in place, and transports it back to the pipe machine.

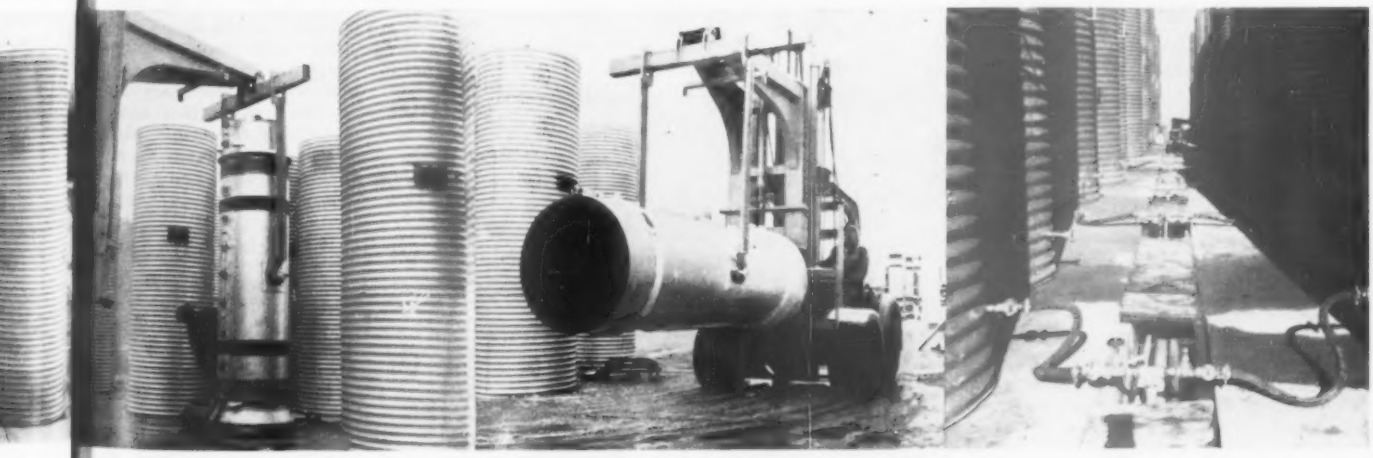
From here the Model 75 Hyster takes over and handles the curing jackets, molds and pipe. You can see how it works in Fig. 17. The bell forming-rings are provided with three steel U-type legs so the steam can circulate around the mold with the new pipe in it; at each steam inlet of every curing jacket, metal baffles are provided to deflect the steam sideways and not against the steel mold.

After the pipe are steam-cured for about 6 hr., at a temperature from

Fig. 10: Typical view of the mold, handling facilities, and handling machine, which is fitted with a special boom attachment

Fig. 11: Mold is set on its station on the curing lines. This is done by swinging the mold vertically with the bell down

Fig. 12: Close-up of one manifold, containing steam, air and water lines. The glad-hand connectors join steam lines to jackets



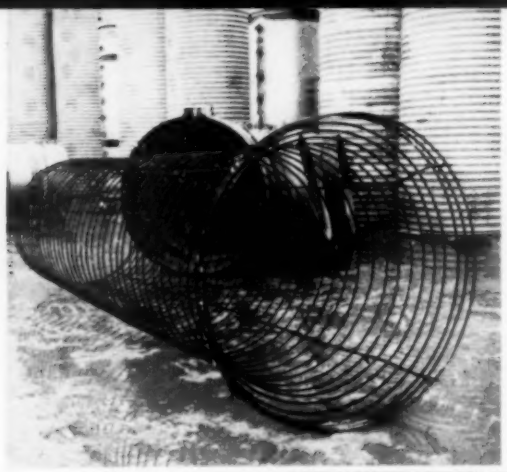


Fig. 13: Steel reinforcement assembly for a 30-in. diameter and 10-ft. long pipe. The circumferential members are spiral-wound on mandrels; four longitudinal members are tack-welded to the circumferential members to form a rigid cage, each provided with four steel spacers

Fig. 14: Handling the curing jackets, molds and pipe. The curing jacket is being removed from the mold, after the pipe has been steam cured for about six hours or overnight

Fig. 15: Small air-jacks, which fit in two expanding lugs, are used to open the molds as shown here. The molds are lifted off the pipe vertically, the pipe is lifted in the same way and the bell-forming rings are tapped with a hammer and fall off

Fig. 16: The spigot-forming rings are removed with impact-tools as shown here, after the pipe has been swung into the horizontal position

140 to 150 deg. F. and a relative humidity of 100 percent, the curing jackets are removed and set aside. The pipe is then lifted and the bell forming-ring is tapped with a hammer and it falls off. Then the pipe is swung to the horizontal position and the spigot-forming-ring is removed with impact-tools. The pipe is then set on its station, the steaming jacket replaced, and it is cured for 16 hr. The total time is 22 hr. The pipe are then transported to the storage yard, or are sent to the site for installation in the Nampa sewers.

Because each of the 33 molds was provided with two sets of joint forming-rings, only two pipe could be made with each mold in an 8-hr. day. But the pipe can be lifted from the curing stations, and the forming-rings removed, after only two hours of steam curing. This was done many times while I was in Nampa, from March 2 to 27, 1951.

Steel Mold Assemblies

The steel molds are made with ⅜-in. thick "Corten" steel plate, which is very smooth and requires no oiling. This provides a satin-smooth external surface for every pipe as can be observed from the pictures. Moreover, this, too, is indicative of the tremendous forces to which the concrete is subjected by the Cen-Vi-Ro machines.

The molds are removed from the pipe by simply releasing the latch bolts with air wrenches, and are jacked open with small air jacks which fit in expanding lugs, at the bottom and top of the molds. The molds are held open with wood blocks, after which the air jacks are released. All this takes one man about three minutes. I had to stop him in order to take these action pictures. The mold is lifted off the base rings with the Model 75 Hyster.

After the pipe are removed from the molds, they are set aside on the concrete floor and the steel reinforcement assembly placed in the molds. then the wood blocks at each end are removed with the aid of the same air jacks and re-assembled with the joint forming-rings in each end. The latch bolts are secured rigidly with the air-wrenches. While the molds fit tightly everywhere, there can be no seam-leakage of free-water, because of the very dry concrete mixture used to make the pipe. This is another outstanding advantage of the Cen-Vi-Ro process. Every operation from start to finish is neat and clean and there is no slop or slurry anywhere.

General Conclusions

Because I have been familiar with all phases of the development of the Cen-Vi-Ro process since its inception, and saw the pipe made and tested for internal hydrostatic pressure at Boise, Idaho, in July, 1950, I can say, without any reservations, that this is the outstanding development in the concrete

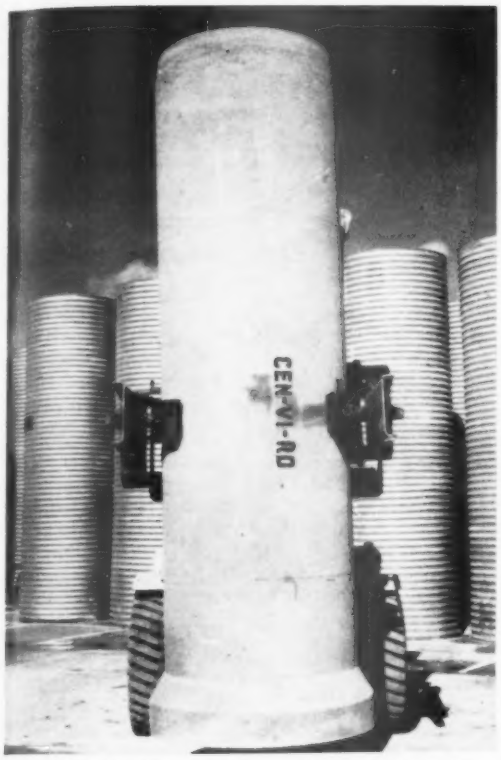


Fig. 17: This view and the cover picture of this section of ROCK PRODUCTS show how easily the heavy pipe are handled. The four rubber-faced grips were designed, manufactured and installed at Nampa

Fig. 18: A 30-in. diameter pipe, 10 ft. long, placed on the hydraulic tester the day after manufacture. The internal pressure was about 40 p.s.i. and there was no leakage at anytime after 72 hr. of testing under this pressure

Fig. 19: Here is shown a 30-in. diameter, 10-ft. long pipe, after the round rubber gasket was installed in the joint, and one in each steel bulk-head at the ends. This pipe was also tested under 40 to 50 p.s.i., without evidence of leakage

pipe industry since 1916. Those using this new process for the manufacture of reinforced concrete sewer, culvert and pressure pipe can make the pipe in long lengths, of from 8 to 12 ft., at nominal production costs. Here are some of the many valid reasons why this is true:

1. The concrete in the pipe shells is very strong, dense and impermeable, because the concrete mixture is processed under enormous pressure. By using about 70 percent coarse aggregates, and about 30 percent of sand, a lower cement content is required to make the pipe. The resulting concrete is more durable than any other kind, because volume change, due to wide temperature variations, is reduced to the minimum. When this process is used to manufacture the concrete cores for reinforced concrete pressure pipe, prestressed, and stress-wound with high tensile-strength steel wire, plastic flow of the concrete will also be reduced to the minimum. Moreover, entrained air is also removed from the concrete mixture by high-frequency vibration and rolling under great pressure.

2. Because there is very little if any free water in the concrete mixture and the entrained air in the concrete mixture is removed, as said before, the bond strength of the concrete to the steel reinforcement is very great. This was demonstrated on March 12, 1951, when one 30-in. diameter pipe, 10-ft. long, was tested by the standard 3-edge bearing test. This pipe had a shell thickness of only 2¾ in. with a steel area of 0.22 sq. in. per foot of pipe length. The 0.01 in. crack was at 4400 lb. per foot of pipe length and the ultimate load was 8400 plus lb. per foot. Extra strength culvert pipe, 30 in. in diameter with a shell thickness of 3½ in. and a steel area of 0.31 sq. in. per foot of pipe length is required under the Standard Specifications for Reinforced Concrete Culvert Pipe (A.S.T.M. Designation C 76-41) of A.S.T.M. to meet the 0.01-in. crack at 5000 lb. per foot and an ultimate load of 7500 lb. per foot. In other words, the City of Nampa is receiving railroad culvert pipe at sewer pipe prices, from the standpoint of structural strength.

3. The Cen-Vi-Ro machine, molds and all pipe handling facilities as well as the curing jackets for the pipe are portable and can be transported to the site of the work, when and if the required quantities of pipe justify such action. This is an outstanding advantage, since the machine can be loaded on trucks. It weighs about 6000 lb.

4. The steel reinforcement is tensioned by the tremendous pressure to which the concrete is subjected. Thus, for the first time, the definition of reinforced concrete, set up in every Standard Specification of A.S.T.M. for reinforced concrete pipe is actually effected in Cen-Vi-Ro pipe. Here is this definition:

"Reinforced Concrete

4. The reinforced concrete shall consist of portland cement, mineral aggregates and water, in which steel has been embedded in such a manner that the steel and concrete act together."

In simple language, this means that the steel being tensioned by the new process takes the tensile stresses before the concrete cracks. This is the reason why day-old pipe, after steam curing for 22 hr. or less, show no wet spots after testing under hydrostatic pressure at 40 to 50 p.s.i. for 72 hr. or more, even when the steel reinforcement was not actually designed, at Nampa, Idaho, for internal hydrostatic pressure.

5. The fine and coarse aggregate may vary in specific gravity, but there is never any separation of the aggregates, cement and water during the manufacture of the pipe. This means that local aggregates of the required quality may be utilized to manufacture concrete pipe of every kind by the Cen-Vi-Ro process.

6. The Cen-Vi-Ro joint assembly is truly watertight, flexible and of simple design so the pipe lines are installed by merely pressing the pipe together. They provide for expansion, contraction, settlement or lateral displacement of any pipe in a pipe line, without leakage of water in excess of

Fig. 20: A 30-in. diameter pipe, 10 ft. long, as shown here, can be deflected from line and grade about 4 in., when installed in a pipe line, without leakage. However, a pipe line should not be expected to perform that way

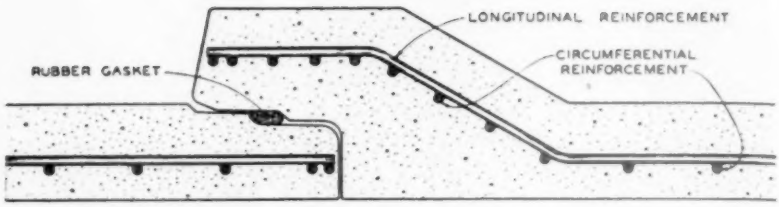


Fig. 21: Cen-Vi-Ro pressure joint

the allowances. When used for sewers, as at Nampa, the joints prevent infiltration of ground waters into the sewers. While this joint assembly has been used in England, Australia and India since 1928 on a vast scale, the Cen-Vi-Ro joint provides for more movement without leakage and is easy to install without injury to any joint. Incidentally, this joint is not restrictive.

The patented joint assemblies for the 30-in. diameter pipe under the tracks of the Union Pacific Railroad in Nampa cost $16.37 each and the double-wall pipe was sold for $14.75 per foot. The Cen-Vi-Ro pipe of 30-in. diameter sold for $4.91 per foot.

The Cen-Vi-Ro process was developed by George R. Jessen, president, and Carl Chanlund, master mechanic, of the Utah-Idaho Concrete Pipe Co., Salt Lake City, Utah, and the Idaho Concrete Pipe Co., Inc., Nampa, Idaho.

Fig. 22: One of the 30-in. diameter, 10-ft. long pipe, with a shell thickness of only 2¾ in. was tested by the standard 3-edge bearing test, required in A.S.T.M. standard specifications. The 0.01-in. crack was at 4400 lb. per foot of pipe length and 8400-lb. ultimate load

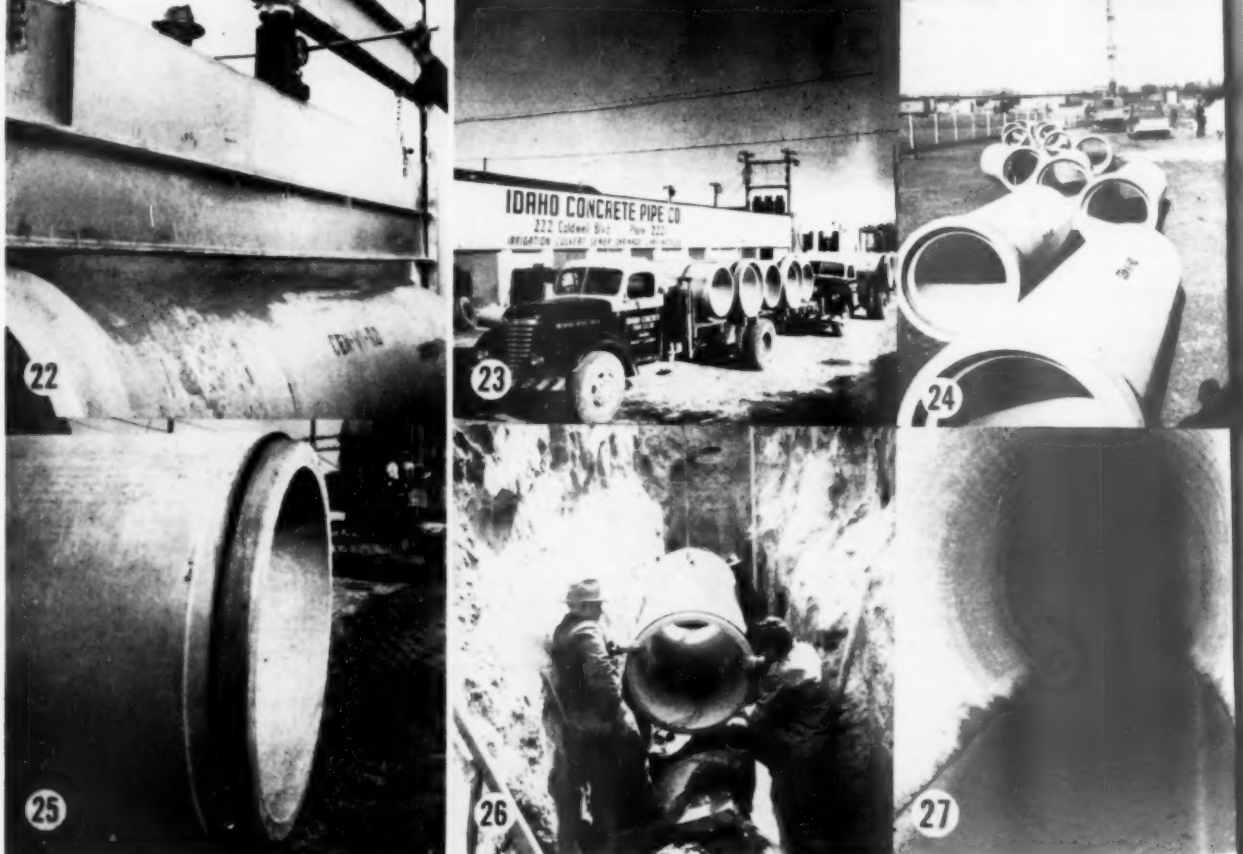
Fig. 23: Here are the first two truckloads of 30-in. diameter, 10-ft. long pipe, ready for delivery to the trench-site at Nampa, Idaho

Fig. 24: Here is the first delivery of pipe. Pipe are cured for 22 hr. at 140-150 deg. F.

Fig. 25: This photograph shows the spigot end of one of the pipe, with the round rubber gasket in place, soaped up and ready to be installed in the trench

Fig. 26: The pipe is here being lowered into the trench. When the pipe are drawn together there is a distinct sound audible

Fig. 27: An interior view of a finished pipe line at Nampa, Idaho. The excellent alignment, smooth surface texture and the complete absence of offsets at the joints are clearly shown



MIDWESTERN READY MIX PRODUCERS MEET

APPROXIMATELY 160 WERE in attendance at the ninth annual convention of the Wabash Valley Ready Mixed Concrete Association held March 19 and 20 in Chicago, Ill.

C. S. Ward, Nelsen Concrete Culvert Co., Mount Vernon, Ill., was elected president to succeed J. H. Rudolph; Ernest Horne, Ready Mixed Concrete Corp., Indianapolis, Ind., is vice-president; and R. E. Hutchins, Rose Polytechnic Institute, is executive secretary.

The association continues to be one of the more aggressive regional organizations, with a membership comprising producers from Indiana, Illinois, Kentucky and from other nearby states, and is doing an effective job in handling industry problems at the state level.

This year's convention covered technical problems of the industry, cost accounting, industrial mobilization, legislative matters, concrete design, equipment problems and the field for ready-mixed concrete in highway construction.

Technical problems were considered in the first session with featured talks by Stanton Walker, engineering director of the National Ready Mixed Concrete Association and by R. E. Copeland, director of engineering, National Concrete Masonry Association, who assisted Mr. Walker in a discussion of lightweight aggregates. Then followed a discussion of cost accounting by A. H. Behme, Concrete Supply Co., Evansville, Ind.

Following a talk on industrial mobilization for war, V. P. Ahearn, executive secretary of the National Ready Mixed Concrete Association, covered in great detail current developments in legislation, labor, taxes and other problems. Mr. Ahearn's talk was patterned along similar lines to the report given at the National Ready Mixed Concrete Association convention at New Orelans, reported in the April issue of ROCK PRODUCTS, with the addition of certain new information developing out of Washington.

The first day's sessions concluded with a reception given through courtesy of the associate members, and the annual banquet.

The Tuesday morning meeting, presided over by C. S. Ward, new president of the association, opened with a talk by B. R. Petrie, field engineer, Portland Cement Association, Indianapolis, Ind., on problems in concrete design. This was concerned with factors to be considered in mixing and using quality concrete. The speaker used many slides to show graphically how mixes could be improved. The water and cement paste is the chief concern, assuming that the aggregates are acceptable, according to Mr. Petrie. How well voids are filled with hydrated cement governs the strength of a specimen. Water content is critical, the speaker said, because if not enough water is added no length of time will bring hydration, whereas if too much water is added bleeding will occur. The strongest concrete made, under controlled laboratory conditions, was said to have only 10-15 percent of the cement hydrated.

Slides showed the effect of increasing strength by decreasing water content variable amounts, the increase in strength by adding 2 percent $CaCl_2$, by longer moist curing and higher curing temperatures. Mr. Petrie recommended that no more than 6 gal. of water per sack of cement be used, since the more water added, the more space the paste takes up. Proper hydration of all cement requires a membrane over the surface.

Equipment problems during the present emergency were discussed by E. L. Fortier, International Harvester Co., Chicago, Ill.; H. S. Peters, Blaw-Knox Co., Pittsburgh, Penn.; and E. A. Smith, C. S. Johnson Co., Champaign, Ill. Mr. Fortier confined his talk to preventive maintenance. In the past this subject has been oversold, he said, saying that it can't work miracles. A preventive maintenance program should include the following checks on a vehicle: inspection, adjustment, tightening and cleaning. A good program will show many accomplishments: keep vehicles in good operating condition, keep costs down, and prolong vehicle life.

Mr. Fortier said that PM forms are available from most equipment manufacturers. International Harvester, he said, is bringing out a new set of forms. In conclusion, the speaker said that any program will be affected by these factors: (1) vehicles should be of capacity the job requires, (2) train drivers, (3) mechanics training, (4) management backing, and (5) proper records of equipment.

Mr. Peters discussed truck mixer operation. He suggested that mixers be kept clean, not to overload mixers and that drivers be taught proper mixer operation. A water-insoluble grease should be used on mixers which, though more expensive, lasts longer, he said.

Mr. Peters brought up the matter of load limits, saying that he feels the weight limitation problem is just beginning. He suggested that producers should select trucks carefully because more states are passing the 18,000-lb. single axle weight restrictions. A 3-cu. yd. mixer thus might better be mounted on tandem axles, for instance.

Mr. Smith described a new piece of equipment recently developed by C. S. Johnson Co., the Johnson rocking mixer. Every three revolutions of the drum it rocks sideways. This feature enables 6 cu. yd. to be mixed in a drum no larger than the conventional 4-cu. yd. mixer in 50 percent of the time ordinarily required, he claimed.

Mr. Smith next discussed the DO ratings and the methods of obtaining maintenance repair and operating supplies. (See ROCK PRODUCTS, April 1951, page 95, for details of NPA regulations).

A. R. Lonier, engineer of materials, Illinois Department of Highways, spoke on the use of ready-mixed concrete for highways. His first statement was that responsibility for quality of concrete goes back to the ready-mixed concrete producer as the supplier of the aggregate and all constituents. Concrete is one of the most abused of all construction materials, he continued. Poor construction practices give poor results. Then there are so many opposing elements to proper use, such as ignorance, and indifference by users.

The speaker told a composite story of a garage that ordered a driveway to be constructed. When costs were shaved and shortcuts taken, the driveway disintegrated. Mr. Lonier's point was that the ready-mixed concrete producer should have followed through on the proper use of the concrete.

Concrete Products Meeting

CONCRETE PRODUCTS MANUFACTURERS ASSOCIATION of South Dakota held its fifth annual convention at the Lincoln Hotel, Watertown, S. D., March 1-3, 1951. The convention opened with a panel discussion on sanitary farm buildings. Other sessions included talks on concrete aggregates and a review of the national convention held in Cleveland, Ohio. Social activities included a banquet and program on Thursday night. Watertown Concrete Products Co. held open house Friday afternoon for those who wished to visit the plant.

Officers and directors of the association are Arnold Josten, Sioux Falls, president; J. B. Dyer, Gregory, vice-president; Merrill Allen, Watertown, secretary-treasurer; and Les Kennedy, Rapid City; Curtis Gilbert, Huron; William Gage, Sioux Falls; Ronald Splinter, Milbank, and Al Gage, Sioux Falls.

Transferring loaded block from machine to curing room on hand lift truck

COLORED MASONRY UNITS

NATURAL PIGMENT COLOR is used by Rockford Brikcrete Co., Rockford, Ill., to produce colored concrete block in its new plant. At present, block are produced in three colors: red, tan and buff, in addition to the natural gray. White block as well as additional colors will be introduced to the trade if the demand for them is sufficient.

These special block are made in two sizes: 4 x 3½ x 12 in. and 8 x 3½ x 12 in. Corner and half block for both sizes are also made. The block machine forms two 8-in. equivalent units per cycle. Production cycle of the machine is as follows: feed drawer, filled from overhead concrete hopper, moves forward over the mold box, with complete filling of the mold assured by mechanical vibration applied to the unit at this time. Next, a stripper plate is brought down on top of the unit by a hand lever. This stripper plate has two functions: it acts as a tamper and it strips the finished block from the mold upon completion of the cycle. A second hand lever lowers the pallet carrier and permits the block to be stripped out the bottom of the mold box. Capacity of the machine is 250 8-in. equivalent block per hour.

Block machine, skip hoist and concrete mixer at this operation are all products of Brikcrete Associates, Inc., division of W. E. Dunn Manufacturing Co. Producers of these special block operate under franchise from the former company in a protected area.

Only sand and gravel block have been made to date, but expanded perlite is being investigated as a possible aggregate for production of a lightweight block. Aggregates for the mix are proportioned to a 16-cu. ft. skip-hoist bucket by shovel from piles dumped to floor storage by truck. Low block walls have been erected around this area to keep floor-storage piles neat. Travel of the skip-hoist bucket is 17 ft. At the top of the hoist, the bucket is automatically dumped to a 16-cu. ft. tub-type concrete mixer with a plunger-type bottom discharge opening. Both mixer and skip hoist are powered through V-belt and gear-reduction units by one 7½-hp. General Electric motor.

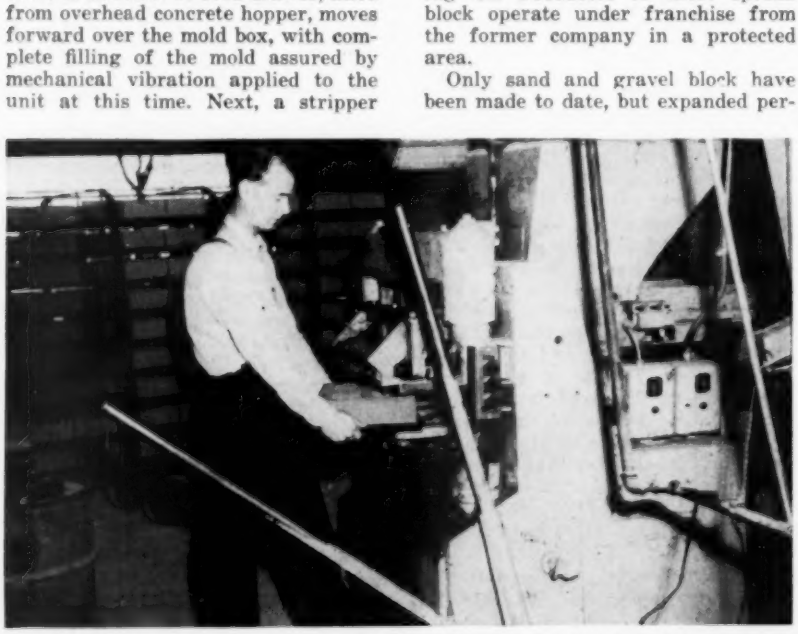
Part of storage yard of colored concrete block

Mixing time is 4 to 5 min. dry and 5 min. wet. Water is proportioned with a Buffalo meter. Bagged air-entraining cement is used or air-entraining admixture is added to standard portland cement. The mineral pigment additive is weighed out in a small pan scale next to the mixer. Different amounts of pigment are added depending on the source or type of pigment and the intensity of color desired.

Although the company only operates one block machine at present, a pants-leg chute has been provided under the concrete mixer so that a second machine can be added in the future with a minimum of trouble.

Block are transferred from the machine to special steel curing racks that have a capacity of 216 8-in. equivalent units. The racks are moved from the machine to curing room or from curing room to storage area by a Service Caster hand lift truck. The curing room, built with plant-produced block, has only recently been completed and various methods of introducing steam are being considered.

W. Karl Minert is owner and plant manager of Rockford Brikcrete Co.



W. Karl Minert, owner and plant manager of Rockford Brikcrete Co., at block machine; two levers, foreground, are for stripping and tamping

Precast Concrete Steps

DAYTON CONCRETE STEP CO., Dayton, Ohio, in operation since 1949, is producing ready-made concrete steps. It is said that the company produces the only ready-made concrete steps in that area which are cast in a single unit—not assembled. The steps are available in 5- and 6-ft. widths, with or without platforms or iron railings.

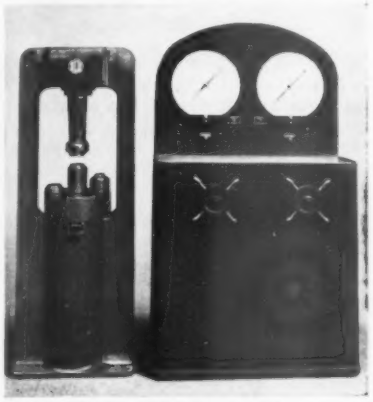
NEW MACHINERY

Testing Chart

CHARLES R. WATTS & Co., Seattle, Wash., has developed a chart for use with the Press-Ur-Meter, a device for quickly testing air entrained concrete which was introduced by the company about a year ago. Said to enhance the value of the meter this chart has been developed in order to make accurate specific gravity and moisture tests.

Concrete Testing Machine

BALDWIN-LIMA-HAMILTON CORP., Lima, Ohio, has redesigned, to separate the loading and weighing units, a concrete testing machine of 100,000



Two-unit testing machine

lb. capacity, similar in operation to the 90,000-lb. machine which it replaces. It is designed primarily for testing 2-in. cubes and 3- x 6-in. cylinders, but it is said that the stroke and dimensions of the working space are large enough to permit many other uses. The two-unit design is said to prevent transmission of load shocks to the indicator and keep the operator out of range of flying or falling particles from breaking specimens.

Concrete Admixture

ORONITE CHEMICAL Co., Chicago, Ill., has summarized, in a technical service report, the use of an admixture, D-40, in the manufacture of concrete and cinder block for the building industry. The company claims that block made by the D-40 process are smoother, more uniform, easy to use, and are produced both economically and quickly.

Concrete Block Machine

FLEMING MFG. CO., St. Louis, Mo., announces the Fleming FMC 180 Block maker, 33-in. wide, 70-in. long and 66-in. high. It is factory adjusted for 180 complete cycles per hour. Only one man is required, whose duty is to place the pallet on the mold box and off-bear the block. Push button controls the complete operation, the manufacturer advises.

This plain pallet vibrator produces uniform sharp edge, quality block, the manufacturer states. Interchangeable mold boxes are equipped with heat-treated replaceable liners, wear plate and stripper plates. A variety of block sizes and shapes can be produced. The all steel vibrator operates with unbalanced shafts, sealed, vibration pulsating in all directions assures thorough compaction. A speed of 5300 r.p.m. is obtained of the unbalanced shafts by a 2 hp., 3 phase, 60 cycle, 1750 r.p.m. motor. Hydraulically operated power plant is mounted in back, has a 1½ hp., 60 cycle, 3 phase, 1750 r.p.m. motor. Six way valve controls the low pressure hydraulic operation. Large fluid reservoir insures more than ample cooling liquid.

The block machine weighs approximately 1800 lb. The rate of block production can be varied; 180 standard block per hour is considered normal.

Lightweight Truck Mixer

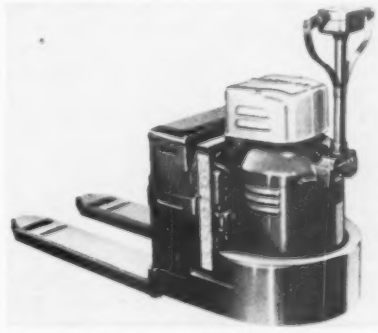
BLAW-KNOX Co., Pittsburgh, Penn., has developed a lightweight standard complete truck mixer. The weight of the 3-cu. yd. model has been reduced by a ton and the 4½-cu. yd. model by

Lightweight truck mixer

a half ton. The weight reduction and improved performance are said to have been made possible by a simplified piping system, a double-strand roller chain drive and a compact transmission of modern design.

Electric Pallet Truck

TOWMOTOR CORP., Cleveland, Ohio, has announced its Model W pallet truck, built to handle pallet loads weighing up to 4000 lb. The manufacturer states that among the new features of the truck are a contractor panel, a positive-action brake, improved differential action and all-rubber, dual trailer wheels.



Truck for palletized loads

Center-Control Fork Truck

THE BAKER-RAULANG Co., Baker Industrial Truck Division, Cleveland, Ohio, has announced the Type FS center-control fork truck, for applications where loads are 2000 lb. and 48 in. long. Some of the specifications are as follows: outside turning radius, 65 in.; right angle turn, 79½ in. plus length of load; overall height, 83 in.; telescoping lift, 130½ in. loaded; and initial lift, 65 in. loaded.

Block Rack

EQUIPMENT MANUFACTURING, INC., Detroit, Mich., has engineered a special type rack for handling concrete block. According to the manufacturer, the new rack is designed to eliminate

Rack for handling concrete block

individual block handling and make multiple handling practical in drying and curing, storing and shipping to the job. Of welded structural steel construction, it holds 12 steel or wood pallets of the size used for casting four block, a total of 48 block.

Weigh-Batch Unit

MIXERMOBILE MANUFACTURERS, Portland, Ore., has introduced a portable concrete unit, known as the

Portable concrete weigh batcher

Weigh-Batcher. The unit weigh-batches aggregates on the job, and may be combined with the company's concrete mixing and elevating unit and its Scoopmobile to make a portable plant. The manufacturer claims a capacity of up to 50 cu. yd. per hour. The machine is powered with a gasoline engine and travels at normal highway speeds.

Blade attachment for excavating and trenching

Backfill Blade

SCHIELD BANTAM CO., Waverly, Iowa, has produced a backfill blade attachment which, it is said, greatly speeds covering and levelling of all types of excavation and trenching work. The backfiller consists of a cable-operated steel blade mounted on a wish-bone dip stick, with two tubular control arms that hold the blade vertical to the ground as it is pulled toward the machine.

Extends Fork Truck Line

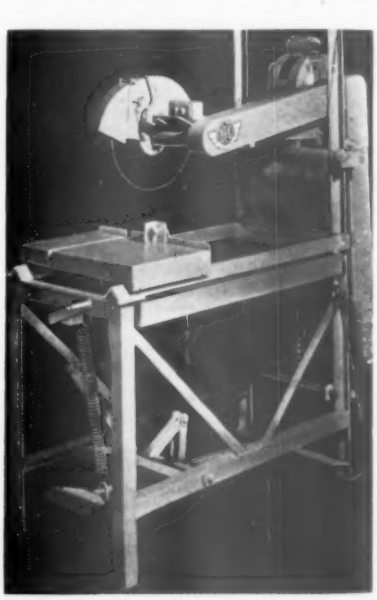
THE BUDA CO., Harvey, Ill., is manufacturing 2000-lb. capacity fork lift trucks, which incorporate short length,

Fork truck of 2000-lb. capacity

short width and narrow turning radius. The two models are available in 24-in. and 15-in. load centers, are powered with 4-cyl., 61-cu. in. displacement engines, and are available in five standard masts with lifts of 72, 84, 108, 114 and 120 in.

Masonry Saw

THE SUPREME EQUIPMENT CORP., Cleveland, Ohio, has developed an all-steel masonry saw, in both wet and dry cutting types, and using abrasive or diamond-type cutting wheels. The manufacturer claims that this machine is able to precision-saw any size, any type and any hardness of masonry material. It is said that the saw is designed to permit use of the cutting wheel right down to the hub, thereby



All-steel engineered masonry saw

cutting cost of operation and affording greater use from each wheel. The machine is powered by a totally-enclosed, heavy-duty 1½-hp. motor.

Extends Truck Line

THE WHITE MOTOR CO., Cleveland, Ohio, is manufacturing a new truck, said to be specially engineered for concrete products industries, because of the functional design and the use of a weight distribution principle which permits additional carrying capacity and better maneuverability on the job. This White 3000 series also features the power-lift cab which, it is claimed, provides complete front-end accessibility for easier maintenance.

MACK TRUCKS ... for All-Out Effort

● Today's all-out effort in National Defense and civilian supply places an ever-increasing strain on truck equipment. Fact is, up to 75% of all incoming and outgoing materials at the nation's defense plants are now hauled on motor trucks.

Under such emergency conditions "Built Like A Mack" takes on added significance . . . means trucks that stand up better under the punishing wear and tear of bigger loads and more intensive service.

Wherever they operate . . . in whatever phase of the national economy . . . Mack trucks have one thing in common. Being Macks—they're built to outlast them all—to give *long-lasting* economy and reliability. That's a basic Mack advantage, vitally important during periods of uncertainty when replacements may be difficult to obtain.

Your nearest Mack branch or distributor has the right Mack for your particular line of business—a truck that's built better to give you benefits in low-cost maintenance and peak performance for many years to come.

Mack TRUCKS

. . . outlast them all

Mack Trucks, Empire State Bldg., New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

Punishing ready-mix service calls for the ruggedness which has marked Mack construction for over half a century. This Mack Model A-405 is one of 26 Macks serving Dallas Concrete Co., Dallas, Texas.

Sakrete Producers Meet

OVER 25 PERSONS were present at the meeting of the Sakrete Producers which was held February 9 and 10 at Edgewater Park, Miss. The morning session on February 9 was under the chairmanship of Albert Cummins. This meeting opened with a paper by Marshall Terry, former vice-president of Crosley Broadcasting Corp., in which he outlined recommended practices for national marketing. His talk was followed by a presentation of the Dartnell Corp. on sales training. John Wilkerson of the Universal Match Corp. then spoke on the use of book matches in promotion. A presentation by the Reuben Donnelly Corp. called "Taking the Hide and Seek Out of Selling," was presented to show the advantages of the use of telephone directory advertising in a coordinated merchandising plan under Sakrete's national trade mark.

The afternoon session was under the chairmanship of Tom Popplewell, of Texas Dry Concrete Co. A paper prepared by Marshall Trimble of *Building Supply News* on trade paper advertising was presented. Following this paper, a representative of each Sakrete licensee gave a ten-minute talk explaining his methods of merchandising. Each talk was supported by an exhibit of advertising and merchandising material.

These talks were followed by a general discussion period on national advertising. It was agreed by the group that cooperative purchasing of all advertising material, in order to take advantage of quantity purchases to reduce the cost, was in order. On the strength of this, a committee composed of Albert Cummins, sales manager, Sakrete div., Harry T. Campbell Sons' Corp., Baltimore, Md.; Robert Rausch, sales manager of the W. R. Bonsal Co., Lilesville, N. C.; and John Stewart, sales manager of the Texas Dry Concrete Co., Fort Worth, Texas, was appointed to review all advertising material and to make a report through the Cincinnati office to all the licensees, offering them the advantages of cooperative purchasing.

The feature of the meeting was a talk by Robert Howe, instructor in civil engineering at the University of Cincinnati, who has been retained by Sakrete, Inc., to conduct research work under a research contract with the university, for the development of new products for the Sakrete group. He told the members about his work on a new material which tests have proved thus far to be superior to a standard grade of concrete.

In addition to his talk, he actually demonstrated the comparative qualities of the new mix with a standard Sakrete, which is composed of cement and aggregate. He made compression, tension, and flexural tests, and showed the group that in tension and compression it was more than twice as strong as a good grade of concrete, and in flexure it was as much as five times

as strong. He also demonstrated the new material's resistance to impact. Allowing a 1¼-lb. ball to fall 18 in. against a ½-in. slab of standard concrete, the slab was shattered in five or six blows while the new material withstood 50 blows without signs of cracking or shattering. He indicated that his tests had progressed far enough to make it possible for the product to be placed on the market within the next year.

It was decided to hold the next annual meeting of the Sakrete group in Cincinnati next winter.

Following the sessions, Arthur C. Avril, president of Sakrete, Inc., entertained at cocktails and dinner. At the dinner John Stewart, Texas Dry Concrete Co., was awarded a plaque for his presentation of merchandising and marketing materials. Each of the ladies present was given a corsage of gardenias and a souvenir glove holder.

Western Products Meeting

CONCRETE PRODUCTS ASSOCIATION of Washington held its annual spring meeting, March 17, 1951, in Seattle, Wash. Seventy-six members and guests were present, representing 40 organizations.

The booklet, "Recommendations for Concrete Masonry," was presented at the meeting. The booklet contains construction details, technical data and general information concerning the use of concrete masonry. The members have fostered this book for nearly two years, in a progressive effort to establish sound practices for products users in their area. Copies of the booklet may be obtained from the association office at 328 Third Ave., West, Seattle 99, Wash.

Two new programs that are underway were reported on—advertising and plant safety. Beginning with the May issue of *Sunset* magazine, the association is running ads directed toward residential improvements using concrete masonry. Also, it was reported that, due presumably to the new safety program, there has been a decreasing rate in accidents.

J. W. Sullivan reported on the work just completed by the Concrete Pipe Standards Committee. The report sets forth the common faults found in the investigation with suggestions for corrective measures. Mott Rieke outlined the first welfare programs (group insurance) established in association plants, and explained how the program could be adapted to most of the plants. J. J. Wegner reported on the present dimensional change studies being conducted at Washington State College.

Also included in the program were some talks by guest speakers. W. A. Johnson, architect, Everett, Wash., spoke on "The Architect's Viewpoint on Concrete Masonry," in which he stressed the importance of storing and handling block. Mr. Flood, U. S. Department of Commerce, talked on "Current N.P.A. Regulations," and

personally answered many of the ques-
tions various companies have had. Jim
Breen, Layrite Concrete Products Co.,
Spokane, Wash., gave a detailed ex-
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included. A study of the data indicates that fly ashes differ greatly and that their chemical composition and fineness are of considerable importance to their usability in concrete.

Booklet Describes Pumice

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facturers naturally benefit from it, and the N.C.M.A. is urging its membership to tie in with the P.C.A. advertising locally.

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personally answered many of the questions various companies have had. Jim Breen, Layrite Concrete Products Co., Spokane, Wash., gave a detailed explanation of "tilt-up construction, using soffit tile units" and brought out the economy, low-heat conductivity and general ease with which a Spokane warehouse was constructed by utilizing this system.

The meeting adjourned with the announcement that the summer meeting would be held at Harrison Hot Springs Hotel, British Columbia. While there will be business transacted, the program at this meeting provides an interesting program of entertainment.

Technical Publication on Concrete

NATIONAL SAND AND GRAVEL Association and National Ready Mixed Concrete Association have announced a joint publication covering "Solutions to Problems from Fifth Annual Short Course on Aggregates and Concrete." It presents the problems used for instruction during the short course held last November. The booklet contains detailed solutions to the problems, as compiled by D. L. Bloem, assistant director of engineering of the two associations. Tables and diagrams required for the solutions are also included.

The problems used in the short course were intended to demonstrate basic procedures in designing concrete mixtures, determining yield and batch weights and combining aggregates to produce desirable gradings for concrete. In the booklet they are assembled in four groups, in the order of their presentation at the short course and approximately in order of progressively advanced methods, as follows:

A. Estimating yield and batch weights of concrete. Basic problems in calculation of yield and other characteristics, involving concretes of stated proportions or batch weights.

B. Design of concrete mixtures. Problems in the selection of proportions to produce concrete of specified characteristics, including application of the principles of fineness modulus and B/B_o.

C. Adjustment and design for entrained air. Correction of concrete proportions to compensate for entrained air and direct design of air-entraining concrete.

D. Advanced problems. More refined procedures for taking into account aggregate grading and combining aggregates to overcome grading deficiencies.

As a result of numerous questions submitted concerning the use of fly ash as a replacement for cement or fine aggregate in concrete, Mr. Bloem has also prepared a "Review of Literature on Fly Ash in Concrete." In addition to the summary of the more important available data, a selected list of references to the literature is

included. A study of the data indicates that fly ashes differ greatly and that their chemical composition and fineness are of considerable importance to their usability in concrete.

Booklet Describes Pumice As Concrete Aggregate

A NEW BOOKLET ENTITLED "Pumice As Aggregate for Lightweight Structural Concrete" has recently been published by the University of New Mexico Press. The booklet is number five in the University of New Mexico Publications in Engineering, and was written by William C. Wagner, head, Department of Engineering at the University, Walter E. Gay, formerly project head, Los Alamos Pumice Project of the University, and Dexter H. Reynolds, formerly technical director, Division of Research and Development of the University. The research was undertaken for the Atomic Energy Commission.

Pumice aggregate used in the research came from deposits in New Mexico. Cement used was Type I Federal Specification SS-102, supplied by Southwestern Portland Cement Co., El Paso, Texas. The wide acceptance of pumice concrete as a construction material is due primarily to its light weight, high thermal and fire resistance and low cost. Its use also has disadvantages, the booklet says, chief of which have been excessive cement requirements to attain structural load-bearing strength, and lack of uniformity of aggregate delivered to the job-site, resulting in poor quality control.

The test results indicated, the booklet says, that a lightweight concrete of adequate strength, quality and uniformity may be produced from an all-pumice aggregate, and that this may be done without using quantities of cement greatly in excess of ordinary practice with sand-gravel aggregate. Test results are summarized graphically.

The booklet may be obtained by writing the Editor of Publications, Room 106, Administration Building, University of New Mexico, Albuquerque, New Mexico. The booklet sells for $1 a copy.

Correction

IN THE FEBRUARY ISSUE of ROCK PRODUCTS, it was erroneously stated that the Portland Cement Association, in cooperation with National Concrete Masonry Association, is promoting the use of concrete masonry for residential construction through P.C.A. housing advertisements. The project is being planned, prepared and placed solely by the Portland Cement Association. The only connection N.C.M.A. has with it is that its members as well as other concrete masonry manufacturers naturally benefit from it, and the N.C.M.A. is urging its membership to tie in with the P.C.A. advertising locally.

Foreigners Evaluate U. S. Concrete Plants

FIFTEEN MEMBERS OF the Netherlands concrete products industry who recently visited the United States to study American concrete plants under a technical assistance project of the Economic Cooperation Administration, concluded that a number of modern American tools and methods can be adapted to advantage in their own industry in Holland to improve productivity.

The group, whose members were drawn from Dutch management, labor and technicians, visited plants producing concrete pipe, industrial and home construction equipment and other concrete materials in New York, New Jersey, Pennsylvania, Illinois and Ohio. They also conferred with industry and government officials in Washington. Speaking for the team, Petrus A. Wernick, managing director of N. V. Wernick's Beton Mij, Leiden concrete products firm, noted some specific methods and devices here which can and should be adopted by the Netherlands industry to increase output per man. These include more efficient routing of materials in factory processing, steam curing (which is little used in Holland), and greater use of mechanical rather than manual transport.

The members of the concrete team were just as impressed by American

labor attitudes and by labor-management relations here as they were by the tools and methods employed. One of the most striking differences they found between American labor conditions and those in their own country was the fact that there is no legal restriction in the U. S. such as the law in Holland which prohibits more than 45 hours of work per week. Being allowed to work overtime has helped the American worker to reach a high standard of living, the concrete products team decided.

Labor's attitude in the U. S., as contrasted with that of labor in the Netherlands, was described by the group as follows: "The American laborer realizes better than his European colleague does, that it is to his interest when things go as well as possible in the business where he works. It will be one of the team's greatest tasks to carry this out in Holland."

Bulletin on Test Results of Culvert Pipes

AMERICAN CONCRETE PIPE ASSOCIATION has announced through its managing director, Howard F. Peckworth, the publication in booklet form of the final report of Dr. L. G. Straub, director of the St. Anthony Falls Hydraulic Laboratory, Technical Paper No. 5, Series B, entitled, "Hydraulic Tests on Corrugated Metal Culvert Pipes."

The booklet summarizes the results of five years of research at the University of Minnesota, St. Anthony Falls Hydraulic Laboratory, under the direction of Dr. Straub. The tests were conducted primarily for the purpose of obtaining pipe friction and entrance loss coefficients for concrete and corrugated metal culvert pipes, which would be more accurate and dependable than those currently recommended in culvert design literature. Copies of the booklets are available at 50c each from the association offices, 228 North La Salle St., Chicago 1, Ill.

Cinder Block

MAINE CEMENT PRODUCTS CO., Milford, Maine, organized in 1948, is the only cinder block concern in the state of Maine. The company employs 21 people and makes deliveries from Kittery to Madawaska. Jess Storey, owner and manager, states that the company's main problem has been trying to keep up with sales. In 1950, production totaled 964,000 block. The physical set-up has a capacity of 5,200,000 units annually, so no expansion plans are being contemplated for the present, but production for 1951 is expected to be increased to 1,500,000 block. The firm operates eight trucks of various types for delivery of block and for hauling raw materials. All raw materials used in the plant are obtained locally—cement from Thomaston, sand from Orono, cinders from Millinocket and water from the Penobscot river.

Pool Ready Mix Facilities

CLIFTON COAL AND SUPPLY Co., Lakewood, Ohio, and Goff-Kirby Co., Cleveland, Ohio, have pooled the resources of their ready-mixed concrete plants for the construction of the new Ford Motor Co. production foundry and motor plant near Cleveland. The Clifton company batches all concrete at its Brookpark Road plant, and Goff-Kirby is supplying half the trucks needed to deliver the concrete.

The companies started pouring concrete from the Brookfield plant in July, 1950, and have completed more than one-third of the total 90,000 cu. yd. of concrete necessary for completion of the job.

The Brookfield plant has three mixers, each of 2-cu. yd. capacity. The trucks used have a rated capacity of 3 cu. yd., but by using a wet mix, the eqivalent of 4-cu.-yd.-capacity trucks has been attained, which has greatly increased the production rate. On one day last November, the Brookfield plant supplied a total of 1039½ cu. yd. of concrete—setting a new record for daily total production for any of the company's branch plants.

The Brookfield plant has in operation two of the new J. W. Materials Co.'s calcium chloride dispensers. It was stated that the new dispensers make it easier to add calcium chloride, in solution form, to the concrete, and to get more uniform results. A 2 per-

cent calcium chloride solution, by weight of cement, is used. Calcium chloride is used in all concrete batches that leave the plant during cold weather periods.

Concrete Bibliography

A 2-VOLUME PUBLICATION, entitled "Bibliography of New Developments in Concrete, 1944-1948" has been announced by J. J. Berliner & Staff, New York, N. Y. It contains all available reference sources, classified and indexed by products and subject matter. It includes such topics as admixtures; lightweight aggregate concrete; bond stress, volume changes and plastic flow in concrete; resistance of concrete to abrasion and erosion; compression arches; rigid frame-bridges; concrete structures; building codes; winter concreting methods; vibration; inspection; concrete mixtures; paint; pavements; floor finishes and highway research.

The volumes may be obtained for $12.50 from J. J. Berliner & Staff, 840 Broadway, New York 3, N. Y.

Wichita Goes Concrete

FIVE WICHITA, KAN., industries that produce concrete building materials are expanding their plants, at a cost of more than $500,000, to meet the anticipated growth of Wichita, according to recent reports.

United Cement Products Co. is doubling its capacity by increasing the size of its plant, adding new steam kilns and other equipment. When completed, plant capacity will be about 25,000 block per day.

Kansas Coal & Material Co. is more than doubling its capacity by the addition of a new machine that can produce 720 concrete block per hour.

Walt Keeler Co., Inc., reports it is buying or rebuilding 21 White dual tandem, 6- x 6-transit mixer trucks by June 1. It has just recently completed the addition of eleven 3-cu. yd. transit mixers mounted on White trucks.

Dolese Brothers is building a third batching plant in southwest Wichita where a building boom is anticipated.

Allen's, Inc., has ordered three 4½-cu. yd. mixer trucks, bringing the total fleet of transit mixers to 16.

Concrete Block in Australia

THOMAS BERNARD HAMPTON, managing director of T. B. Hampton Ltd. of New Zealand, has announced that permission is being sought from the Australian government to install five Besser Vibrapac concrete block machines, complete with accessory equipment, in Australia. If government approval is received, the Hampton company plans to place one plant in Brisbane, another in Newcastle, two in Sydney and one in Adelaide. The Vibrapac plants are now enroute to New Zealand, where Hampton's firm is the Besser Co.'s representative.

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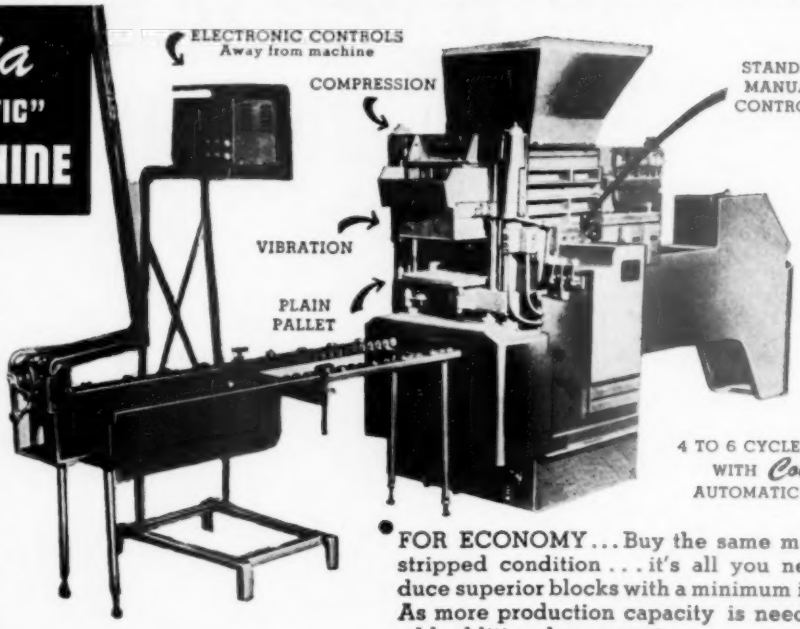

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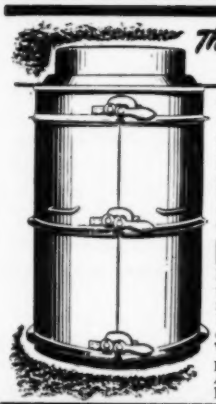

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